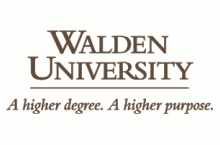

2019

Relationship Between Adolescent Perception of Harm, Electronic Cigarette Use, and Texas Antitobacco Campaigns

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This is to certify that the doctoral dissertation by

Candace Rasheedah Campbell

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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The Office of the Provost

Walden University
2019

Abstract

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by

Candace Rasheedah Campbell

MPH, A.T. Still University, 2011

BS, University of Arkansas- Pine Bluff, 2008

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

November 2019

Abstract

The increase in use of e-cigarettes in adolescents is a major public health concern that must be addressed. Research studies showed some e-cigarettes contained varying amounts of nicotine and sever cancer-causing chemicals. The purpose of this quantitative, cross-sectional study was to assess the perception of harm (dependent variable) from using e-cigarettes and being exposed to state and school-based antitobacco programs (independent variable) and to determine if the association was modified by socioeconomic status or area of residence. Attitude-social influence-self-efficacy theory was the chosen theory for research and suggests that attitude, social influence, and self-efficacy variables can be persuaded via specific health promotion activities. Texas students enrolled in 6^{th} to 12^{th} grade of an eligible school who voluntarily consented to participate and received written authorization from a parent were included. Nearly half of participants out of N=9,239 adolescents considered e-cigarettes very dangerous, yet more than half reported using the device. Ordinal logistic regression was used to determine the relationship between the independent and dependent variables. The results concluded that though majority of adolescents perceived e-cigarettes as harmful, exposure to state and school antitobacco programs are not completely effective at discouraging use. The findings of the study may provide potential impact for positive social change for adolescents and tobacco cessation by increasing understanding of what factors are associated with increased/decreased perception of harm. Results of the study may encourage public health professionals to create and disseminate tailored antitobacco educational information including school and state activities and resources.

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Dedication

This dissertation is dedicated to my mom and dad. Thank you for always encouraging me to shoot for the stars. Thank you for protecting me and inspiring me to be great. I could not have done this without your love and support. I love you dearly.

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During the course of writing my dissertation, I have received amazing feedback and support throughout this process from my committee members. I would like to thank Dr. Michael Dunn and Dr. Linda Marc for agreeing to become my mentors during my dissertation process. Your valuable guidance provided me with the resources and tools that I needed to complete my dissertation successfully. I would like to acknowledge Dr. Robert Hijazi for agreeing to provide his expertise and support during this process. Your wealth of knowledge, time, and assistance has been a tremendous help throughout my dissertation journey. I am extremely grateful for the opportunity and would like to say thank you for everything.

In addition, I would like to thank my village of family and friends, who stood by me throughout this entire journey. They pushed me to continue even when I wanted to give up. Thank you for being my cheer team whenever I felt as if I had no one in my corner. For the countless hours of letting me vent my frustrations, wiping my tears, and refusing to let me use the word cannot, regardless of the fight, I should always finish strong. Most importantly, thank you for believing in me and to see my dream come into fruition because of this I will be forever grateful.

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Chapter 1: Introduction to the Study

Electronic cigarettes have become increasingly popular in the United States (Dutra & Glantz, 2014). In 2013, 15% of adults in the United States reported having ever tried an electronic cigarette (Pepper, Ribisl, Emery, & Brewer, 2014). Among high school students, current electronic cigarette use increased by nearly 9% rising to 13.4% between 2013- 2014 accounting for nearly 2 million students (Centers for Disease Control and Prevention [CDC], 2015). In 2015, more than 27% of United States youth and young adults had tried electronic cigarettes (U.S. Department of Health and Human Services [DHHS], 2016). With the increased popularity of electronic cigarettes, consumption could pass the use of traditional cigarettes within the next 10 years (Polosa, 2015).

Some tobacco companies claim that using electronic cigarettes over traditional cigarettes is a healthier alternative (Mayo Foundation for Medical Education and Research, 2014). Yet, their safety is still unknown. Preliminary research done by the Food and Drug Administration (FDA) showed some devices contained varying amounts of nicotine and several cancer-causing chemicals (Mayo Foundation for Medical Education and Research, 2014). The effects of nicotine in youth differ than that of adults. Nicotine can negatively affect brain development of adolescents (DHHS, 2016). It is imperative that more research is conducted to understand how youth are affected by the consumption of e-cigarettes. It is even more imperative that public health officials understand how effective current antitobacco campaigns are among the adolescent population.

This chapter includes background information on tobacco use and prevalence, health concerns associated with tobacco use, the rise of electronic cigarettes, and the potential health effects associated with its use in adolescents while providing greater detail on the problem, purpose, nature of the study, and research question. This chapter will also include the theoretical framework, assumptions, limitations, and the significance of the study.

Background

Tobacco Use

Tobacco use is attributed as the leading cause of premature disease and death in the United States and worldwide (Drummond & Upson, 2014; King, Dube, & Tynam, 2012). It is considered a risk factor for the leading cause of death associated with heart disease, lower respiratory infections, chronic obstructive pulmonary disease (COPD), cerebrovascular disease, tuberculosis, and lung cancer (Drummond & Upson, 2014). In the United States alone, an estimated 443,000 adults die annually due to the use of cigarettes (King et al., 2012). Of those, more than 49,000 die due to complications of secondhand smoke (SHS) (King et al., 2012). More than 4,000 chemicals are found in tobacco smoke (Gilmour, Jaakkola, London, Nel, & Rogers, 2006). Smoking affects every cell and organ in the body, with approximately 8.6 million people suffering from a smoking-related illness in the United States (Hudson & Mannino, 2010). Medical-related expenses and loss of productivity is annually costing the United States $96 and $97 billion, respectively (King et al., 2012). With the increased prevalence of morbidity and mortality and medical expenses, tobacco use remains a great concern to the public.

Prevalence of tobacco use. Despite the decrease in the prevalence of tobacco use, use of electronic cigarettes has increased rapidly (Agaku et al., 2014). Researchers from the CDC conducted a study in 2011 that found approximately 20% of young adults in the United States smoked cigarettes (Richardson, Williams, Rath, Villanti, & Vallone, 2014). Richardson et al. (2014) found that young adults (age 18-25) have the highest prevalence of overall tobacco use at nearly 41% when compared to youth and adults. Richardson et al. also concluded that majority of the users surveyed reported either dual-use (two products) or poly-use (multiple products) of tobacco products.

Researchers analyzed the National Adult Tobacco Survey and found that in 2009-2010, one in four adults used tobacco in the United States (King et al., 2012). The overall prevalence of any tobacco use, cigarette use, and the use of smokeless tobacco was 25.2%, 19.5%, and 3.4%, respectively (King et al., 2012). The results were consistent when the study was repeated in 2012-2013. Prevalence of all tobacco use was 25%, cigarettes use was 18%, and smokeless tobacco was 3.8% (Agaku et al., 2014).

Though cigarette smoking has decreased in adolescents, use of other tobacco products such as hookah and smokeless tobacco has evolved (Jamal et al., 2017). Hookah is defined as a water pipe that is specifically designed with flavored tobacco (Martinasek, McDermott, & Martini, 2011). They are typically used in a group setting. Smokeless tobacco, such as chew and dip, is associated with various health outcomes such as oral disease and cancer (Boffetta, Hecht, Gray, Gupta, & & Straif, 2008). Though the trend of smokeless tobacco has slowed, majority of adolescents initiate use between 12 and 17 years of age (Lipari & Van Horn, 2017).

Social determinant factors. Social determinants are also factors in tobacco use prevalence. Prevalence rates are typically higher in men (31.8%) compared to women (17.5%) (Agaku et al., 2014). Tobacco use is higher in non-Hispanic Blacks and Whites (25.5%; 24.6% respectively) compared to non-Hispanic Asians (8.8%) and Hispanics (15.9%) (Agaku et al., 2014). Prevalence rates have shown to decrease based on annual income level with individuals with an annual income of <$20,000 having a higher prevalence of tobacco use (32.7%) compared to individuals making ≥$100,000 (12.8%) (Agaku et al., 2014). Additionally, individuals with higher education (graduate degree = 6.3%) have lower prevalence rates of tobacco use compared to individuals with a GED (47.3%) (Agaku et al., 2014). Heterosexual individuals (24.4%) were less likely to use tobacco compared to the lesbian, gay, bisexual, and transgender (35.8%) community (Agaku et al., 2014). These trends remained the same for those who only used cigarettes or used smokeless tobacco.

Factors associated with tobacco use in adolescents can vary drastically. Socially, tobacco use is considered a norm and promoted in the media and among peers as acceptable (McCool, Freeman, & Tanielu, 2014). Adolescents are also affected genetically and biologically (Bierut & Cesarini, 2015). Adolescents are more likely to become addicted to nicotine earlier than adults (DHHS, 2016). Expectant mothers who use tobacco during pregnancy increase the likelihood that the child will also become a smoker (DHHS, 2016). Other factors such as personal perception, low self-esteem, and tobacco advertising also influence tobacco use (Andrews, Netemeyer, Burton, Moberg, & Christiansen, 2004). Social determinants of health strongly influence the prevalence of

tobacco. Understanding the relationship between tobacco use and social determinants of health helps to understand why certain populations have a higher prevalence of tobacco use than others.

Health Concerns of Tobacco Use

Cancer. During the 1950s, tobacco products were found to contain carcinogens that are linked to cancer, mainly lung cancer (Vineis et al., 2004). In the United States, lung cancer is the main cause of cancer deaths (Hecht, 1999). By 1986, studies showed that tobacco use causes not only lung cancer but also cancers of the lower urinary tract (renal pelvis and bladder), upper digestive and respiratory tracts (including larynx, pharynx, esophagus, and oral cavity), and pancreas (Vineis et al., 2004). Recently tobacco use has been linked to kidney, stomach, liver, and breast cancers (Vineis et al., 2004). Smoking is a leading factor in cancer-related deaths (Kuper, Adami, & Boffetta, 2002) and 33% of all cancers are the direct result of tobacco use (Underwood et al., 2014).

Cardiovascular disease. Cardiovascular disease is considered the leading cause of preventable disease and premature death worldwide (Papathanasiou, Mamali, Papafloratos, & Zerva, 2014). Tobacco use is considered a risk factor in negative health outcomes related to cardiovascular disease (Papathanasiou et al., 2014). Twenty five percent of worldwide cardiovascular deaths in middle-aged adults are the direct result of smoking (Papathanasiou et al., 2014). Use of tobacco is also associated with increased serum concentration levels of triglycerides and total cholesterol (Papathanasiou et al., 2014). Smokers have higher levels of low-density lipoprotein and lower levels of high-

density lipoprotein, thus increasing the development of atherosclerosis or hardening of the arteries (Papathanasiou et al., 2014). Individuals who smoke are two to four times more likely to suffer from coronary heart disease and stroke (CDC, 2018a).

Respiratory disease. Respiratory disease is typically a contributing factor of having acute respiratory infections, tuberculosis, COPD, asthma, and lung cancer (Ferkol & Schraufnagel, 2014). Approximately four million people die each year from a respiratory-related disease (Ferkol & Schraufnagel, 2014). In 2012 alone, more than 8.6 million people were infected with tuberculosis and more than 1.3 million people died, primarily residents of sub-Saharan Africa (Ferkol & Schraufnagel, 2014). Worldwide, 235 million people have asthma, which contributes to 180,000 deaths annually (Ferkol & Schraufnagel, 2014). COPD (the obstruction of airflow) is the fourth leading cause of death worldwide, with approximately 200 million people suffering from the disease (Ferkol & Schraufnagel, 2014). By the year 2020, COPD will become the third most common cause of death (Khan, Fell, & James, 2014).

Asthma is a chronic disease that causes the lungs to inflame and obstruct the airway (Stapleton, Howard-Thompson, George, Hoover, & Self, 2011). Asthma causes wheezing, tightening in the chest, coughing, and shortness of breath (Halldin, Doney, & Hnizdo, 2014). According to the CDC (2019), asthma affects more than 25 million people in the United States, with approximately six million of those being children. The most common trigger associated with asthma is tobacco smoke (Stapleton et al., 2011). Individuals who smoke have higher prevalence of negative asthma outcomes, increased risk of being hospitalized, and increased severity of asthma (Ho, Tang, Robbins, & Tong,

2013). Health outcomes associated with the use of e-cigarettes in individuals with asthma are currently unknown.

Secondhand smoke exposure. Though tobacco use is the single greatest cause for premature death, SHS is responsible for increased morbidity and mortality in individuals who do not smoke (Kalkhoran, Neilands, & Ling, 2013). Exposure to SHS increases the likelihood that infants and children will suffer from asthma attacks, respiratory and ear infections, and sudden infant death syndrome (Homa et al., 2015). Youth affected by SHS exposure are at greater risk of becoming active smokers (Kalkhoran et al., 2013). SHS exposure in adults can result in stroke, coronary heart disease, and lung cancer (Homa et al., 2015). SHS exposure is responsible for 41,000 deaths in adults and 400 infant deaths each year (Homa et al., 2015). SHS remains highly prevalent and is a serious health hazard to those that do not smoke.

Electronic Cigarettes

Electronic cigarettes, or e-cigarettes, are electronic nicotine devices that, when activated by water, heat liquid nicotine and a stabilizing compound resulting in an "aerosolized nicotine vapor" (Drummond & Upson, 2014, p. 237). Introduced by China in 2003, e-cigarettes are perceived to be a healthier alternative to using traditional cigarettes (Bertholon, Bacquemin, Annesi-Maesano, & Dautzenberg, 2013). Little research has been done to conclude effectively if e-cigarettes are harmful or beneficial (Bertholon et al., 2013). Though introduced in 2003, the FDAs e-cigarette regulation did not become effective till August 2016 (FDA, 2016a). In recent studies, e-liquid packaging was found to be mislabeling the amount of nicotine levels present or

promoting the liquid as nicotine free (Goniewicz et al., 2015). With the FDAs recent regulation on e-cigarettes, it is unknown if they will be considered as a tobacco product or a smoking cessation device (Drummond & Upson, 2014). Due to the lack of ingredient labeling requirements, FDA regulation of e-cigarettes was necessary. Manufacturers are encouraged to explore options for creating e-cigarette products that provide cessation benefits and decrease potential health risks (FDA, 2016b).

Prevalence of Electronic Cigarettes

Adult prevalence. Between 2010 and 2011, adults who reported ever trying an e-cigarette doubled from 3% to 6%, respectively (Ramo, Yong-Wolff, & Prochaska, 2015). By 2014, this number had increased to 12.6% of the adult population with 3.7% adults considering themselves current e-cigarette users (Schoenborn & Gindi, 2015). The National Youth Tobacco Survey (NYTS) conducted in 2015 estimated that more than 27% of United States adolescents have tried e-cigarettes (DHHS, 2016). E-cigarettes are becoming the gateway product for traditional smoking. Sixty one percent of adults who never used traditional cigarettes reported using e-cigarettes while 80% of traditional cigarettes users also reported using e-cigarettes (Drummond & Upson, 2014). Adults who are current smokers and have tried an e-cigarette increased from 10% in 2010 to 21% in 2011 (Drummond & Upson, 2014; Ramo et al., 2015).

Adolescent prevalence. In 2014, 3.9% of middle and high school students were considered e-cigarette users (Arrazola et al., 2015). Though this number increased to 5.3% among middle school students and 15.5% among high school students in 2015 (DHHS, 2016), use of e-cigarettes declined in 2017 to 3.3% of middle school students

and 11.7% among high school students (Wang et al., 2018). Dual- or poly-use of tobacco products are also important in understanding prevalence in adolescents. Dual use is more prevalent in eighth and 10th graders while exclusive e-cigarette use has greater prevalence in 10th and 12th graders when compared to conventional cigarette use (DHHS, 2016). With the increase in the prevalence of e-cigarette use, understanding the effects on health is necessary.

Health Effects of Electronic Cigarette

Though long-term health effects associated with e-cigarette use is yet to be examined in detail, researchers have reported some negative effects associated with short-term use. One group of researchers concluded that the use of e-cigarettes may cause airway inflammation (Collaco, Drummond, & McGrath-Morrow, 2015). E-cigarettes are also perceived to be less carcinogenic than traditional cigarettes, however, evidence shows lung and bladder carcinogens detected in e-cigarette users (Collaco et al., 2015). Even though e-cigarettes are considered a healthier alternative to traditional cigarettes, the similarities in health effects may imply that the health outcomes will be the same.

Antitobacco Campaigns in Texas

E-cigarette use is on the rise among Texas adolescents (Texas Department of State Health Services [DSHS], 2017). However, efforts to include e-cigarettes in antitobacco campaigns have yet to be created. Currently, Texas solely focuses on general antitobacco campaigns (DSHS, 2017). More information is needed that shows the relationship of how effective these campaigns are in the adolescent population that use e-cigarette products. More effort is needed in implementing counter advertising and mass

media campaigns for adolescents. Results from this study will provide information on the effectiveness of current school and state antitobacco programs on adolescents across Texas.

Problem Statement

Some tobacco companies claim that using e-cigarettes over traditional cigarettes is a healthier alternative (Mayo Foundation for Medical Education and Research, 2014). Yet their safety is still unknown. Preliminary research done by the FDA showed some devices contained varying amounts of nicotine and several cancer-causing chemicals (Mayo Foundation for Medical Education and Research, 2014).

With the large amount of research on the negative health outcomes of current tobacco products such as decreased life expectancy, increased risk of lung cancer, heart disease, and COPD (Skurnik & Shoenfeld, 1998), e-cigarettes could be a safer alternative since they deliver nicotine without the unknown carcinogens found in traditional tobacco products (Cahn & Siegel, 2011). E-cigarettes are battery operated devices that deliver nicotine via a liquid, typically glycerol (Polosa et al., 2014). This is done without having to use tobacco as a method of burning (Polosa et al., 2014). Since e-cigarettes are becoming more widely used, it is important to understand the health outcomes that could result from their use (American Cancer Society, 2014). Tobacco use is related to several chronic illnesses such as heart disease, COPD, and various cancers (King et al., 2012), but the perceived respiratory health effects of e-cigarettes is unknown. The problem addressed in this study was determining the perception of harm of e-cigarette use among Texas adolescents and the relationship of state and public school antitobacco programs.

Determining perception of e-cigarettes provided an in-depth understanding of why individuals use the product (Gibson et al., 2018). Furthermore, determining how adolescents exposed to antitobacco programs perceive e-cigarette harmfulness helped determine how beneficial campaign programs are working in Texas.

Purpose of the Study

The purpose of this quantitative study was to determine the relationship between current use of e-cigarettes, exposure to state and public school antitobacco programs, and the perception of harm among Texas adolescents. Harm is defined as anything that damages the health of the body either physically or mentally or causes an adverse effect.

The independent variables used in this study were e-cigarette use, exposure to state antitobacco programs, and exposure to school-based antitobacco activities. All independent variables had a nominal level of measurement. The dependent variable was perception of harm and had an ordinal level of measurement. Gender, age, grade level, race, ethnicity, socioeconomic status (SES), and area of residence were included as covariates. Age was a continuous level of measurement, while the remaining covariates had a nominal level of measurement.

Research Question

RQ1: What is the relationship between e-cigarette use and perception of harm among Texas adolescents?

$H_0$1: There is no relationship between e-cigarette use and perception of harm among Texas adolescents.

H_a1: There is a relationship between e-cigarette use and perception of harm among Texas adolescents.

RQ2: How does exposure to state antitobacco programs influence the perception of harm of e-cigarette use in Texas adolescents?

H_02: Exposure to state antitobacco programs does not influence the perception of harm of e-cigarette use in Texas adolescents.

H_a 2: Exposure to state antitobacco programs does influence the perception of harm of e-cigarette use in Texas adolescents.

RQ3: How does exposure to school-based antitobacco activities influence the perception of harm of e-cigarettes in Texas adolescents?

H_03: Exposure to school-based antitobacco programs does not influence the perception of harm of e-cigarette use in Texas adolescents.

H_a3: Exposure to school-based antitobacco programs does influence the perception of harm of e-cigarette use in Texas adolescents.

RQ4: How does the relationship between e-cigarette use and perception of harm differ based on area of residence (state vs. coalition resident) in Texas adolescents?

H_04: There is no relationship between e-cigarette use and perception of harm based on area of residence (state vs. coalition resident) in Texas adolescents.

H_a4: There is a relationship between e-cigarette use and perception of harm based on area of residence (state vs. coalition resident) in Texas adolescents.

RQ5: How does the relationship between e-cigarette use and perception of harm differ based on socioeconomic status in Texas adolescents?

$H_0$5: There is no relationship between e-cigarette use and perception of harm based on socioeconomic status in Texas adolescents.

H_a5: There is a relationship between e-cigarette use and perception of harm based on socioeconomic status in Texas adolescents.

Theoretical Framework

Completing research on the topic of the relationship between e-cigarette use and the exposure to antitobacco programs can use various theoretical frameworks. Several theories specific to perception and adolescents were considered to explain and understand the current knowledge on tobacco use in adolescents. For this study, the attitude-social influence-self-efficacy theory (ASE) was the chosen theory for research. ASE theorists suggested that attitude, social influence, and self-efficacy variables can be persuaded via specific health promotion activities (Babirye et al., 2011). Designed by de Vries and colleagues, the ASE theory combines the theory of planned behavior and the social cognitive learning theory (Bidstrup, Tjornjoh-Thomsen, Mortensen, Vinther-Larsen, & Johansen 2010). Attitude, social influence, and self-efficacy are the three factors that influence behavior (Aziz, Maizaitulaidawati, & Hussin, 2017). An individual's behavior is determined by their intentions (Aziz et al., 2017). Attitude, social influence, and self-efficacy are contributing factors in influencing one's intention (Aziz et al., 2017).

Attitude is defined by Aziz, Maizaitulaidawati, and Hussin (2017) as the anticipated result that an individual believes is likely to occur for performing a certain behavior. For this study, it was assumed that not using e-cigarettes will result in a reduction of harm of morbidities associated with its use. Social influence is the social

pressure and individual experiences to participate or not (Aziz et al., 2017). Individuals who are socially pressured or consider an activity acceptable are likely to act or behave in a certain manner based on the social acceptability (Aziz et al., 2017; Bidstrup et al., 2010). For this study, those who considered use of e-cigarettes as promoting an appealing image or that are socially pressured were more likely to use the product and have a lower perception of harm associated with its use. Self-efficacy refers to the resources one poses to complete a task (Aziz et al., 2017). In relation to this study, whether an individual's access to tobacco educational programs helps one understand the dangers associated with e-cigarette use and influence them to discontinue or not initiate use was investigated. This is discussed in greater detail in Chapter 2.

ASE focuses on the intention of individuals predicting certain health behaviors (Dijkstra, Mesters, De Vries, van Breukelen, & Parcel, 1999). The covariates used in this study may also influence adolescent behaviors and intentions via attitude, social interaction, and self-efficacy (see Dijkstra et al., 1999). This intention is then influenced by social variables, including peers, teachers, and health programs, that will provide the individual with the knowledge and skills necessary to determine their perception of harm. Equipped with the knowledge and skills needed to overcome barriers, the individual's self-efficacy of being successful in following the guidelines would create a practical strategy for intervention (Dijkstra et al., 1999). Based on this theory, adolescents with the intention of not smoking paired with health promotion resources are less likely to initiate the habit (Vries & Mudde, 1998). This theory also helped me determine if current health promotion programs in place were effective.

Nature of the Study

The purpose of this quantitative, cross-sectional study was to assess the perception of harm (dependent variable) from using e-cigarettes and being exposed to state and school-based antitobacco programs (independent variable) and to determine if the association was modified by SES or area of residence. The data analysis controlled for covariates including gender, age, education level, race, and ethnicity. All data was previously collected in 2016 by DSHS. The research design is described in detail in Chapter 3.

Definition of Terms

Adolescent: Adolescence begins with the physiological onset of puberty and ends once an adult identity and behavior are accepted. This period occurs between the ages of 10 and 19 (Sacks, 2003). For this study, adolescent age will range between 11 and 18.

Area of Residence: The location in which the adolescent lives in Texas. They will either be considered a coalition resident or a state resident.

Attitude: Evaluations of a health-related behavior that is either positive or negative (Bidstrup et al., 2010).

Coalition service area: Nine publicly funded areas across Texas that are designed to provide evidenced-based, community-planned environment tobacco prevention and control activities in targeted areas (Public Policy Research Institute, 2016)**.**

Electronic cigarettes: Electronic cigarettes or e-cigarettes are electronic nicotine devices that, when activated by water, heats liquid nicotine and a stabilizing compound resulting in an “aerosolized nicotine vapor” (Drummond & Upson, 2014, p. 237).

Harm. Harm is defined as anything that damages the health of the body either physically or mentally or causes an adverse effect. Used interchangeably with dangerous.

Noncoalition service area: The representative state-wide sample of Texas public schools. These areas are not targeted for tobacco prevention efforts. Used interchangeably with *State-wide area*.

Perception: A complex process where individuals interpret various factors that produce and shape their personal experiences in the world (Dhingra & Dhingra, 2011).

Self-Efficacy: An individual's expectation that they can perform a particular behavior or action (Bidstrup et al., 2010).

Social influence: The manner in which outside variables or individuals influence how one thinks, feels, or acts towards another individual (Bidstrup et al., 2010).

Socioeconomic status (SES): A combined measure of an individual's income, education, and occupation which determines one's economic and sociological standing and is a major determinant factor of health (Winkleby, Jatulis, & Fortmann, 1992).

School-based antitobacco programs: Programs developed to educate adolescents on the dangers of tobacco use, which may include activities such as peer education curriculums and school-based antitobacco prevention events (DSHS, 2009).

State antitobacco programs: Media or ad campaigns that are designed to deter tobacco use in adolescents across Texas (DSHS, 2018).

Assumptions

In this study, I made two assumptions:

- All respondents would answer all survey questions honestly and to the best of their abilities.
- The questionnaire would accurately determine perception of harm of e-cigarette use of all participants.

To assume participants will respond honestly, identities of participants were not collected during the study. The collected data is also not available based on individual schools or districts to increase confidentiality. The scope of the study included questions regarding e-cigarettes, the dangers associated with e-cigarette use, and their level of participation in state or school antitobacco campaigns.

Scope and Delimitations

The research problem addressed was a lack of knowledge of the harmful perception of e-cigarette use and its relationship to state and school-based antitobacco programs currently used. The data, which was previously collected by DSHS in spring 2016, randomly surveyed 250 middle and high schools across Texas. Within each school, individual classes were randomly selected to participate in the cross-sectional survey. Each school and individual respondent had the option to decline participation during the collection period. Survey procedures were designed to delimit data to ensure privacy of the students. Data is only representative of middle and high school students at the state and regional levels. The survey instrument was first modeled from an established collection instrument used by the CDC that was tailored to the intended study population and has been used biennial across Texas since 1998 (DSHS, 2009).

Limitations

The Texas Youth Tobacco Survey (YTS) had three limitations:

- All data were self-reported and under or over reporting of e-cigarette behaviors could not be determined.
- Self-admission to SES by participants might not be accurate.
- The survey data applied only to youth who attend public school, and therefore, was not representative of all persons in the population.

To overcome self-admission bias, the survey instrument must be considered valid. Due to the nature of the study, I did not predict any potential bias.

Significance of the Study

This study is significant because it provided insight into how individuals feel about the effects associated with using e-cigarettes. E-cigarettes are becoming the social norm (Lozano, Arillo, Barrientos-Gutierrez, Reynales Shigematsu, & Thrasher, 2019) Even though limited information is known about health outcomes of e-cigarettes, individuals still believe that this is a safer alternative to using traditional tobacco products (Siegel, Tanwar, & Wood, 2011). By analyzing the results of the study, I was able to determine if individuals who use e-cigarettes do so because they perceive them to be a safer alternative, and if exposure to state and school-based antitobacco programs influenced their perception. The goal of the study was to determine if current health promotion campaigns designed to deter adolescent tobacco use are effective with e-cigarettes. The results of the study allowed me to educate state and local officials on the effectiveness of current tobacco policies or initiate policy changes. This research project

was designed to determine if the perception of harm of using e-cigarettes and exposure to health promotion programs are effective in Texas adolescents. Research data supports that e-cigarettes are perceived as harmful, yet social influences such as teachers and health programs are not effective in educating adolescents and that the current programs are ineffective. An individual's perception would influence one's personal behaviors. Based on the results from this study, these perceptions may influence personal behavior, thus creating social change.

Regardless of the research outcome, there was a chance to create social change to benefit society. Without social change, health of individuals will continue to decline. As a public health official, it is necessary to gain new research to overcome health adversities. Though research has been conducted on e-cigarettes, nothing to date has been released pertaining to the perception of using e-cigarettes. Understanding the perception of risk helped identify individuals who underestimated the level of harm from using e-cigarettes. This influences how public health officials create future health campaigns to better educate society of misunderstandings. This study is the first to explain why adolescents use e-cigarettes to determine the best method to educate consumers on health risks associated with using the product.

Summary

Approximately 443,000 adults die annually from the use of cigarettes (King et al., 2012). Tobacco is the single leading cause of death and disease in the United States (King et al., 2012). Limited information is known about the health effects associated with the use of e-cigarettes. This chapter focused on the need to understand the perception of harm

from using e-cigarettes. The chapter also focused on the need to determine if current health promotion programs are effective towards decreasing initiation of e-cigarettes. This will ensure that health officials create effective campaigns that work specifically for adolescents and e-cigarettes.

In reviewing the literature associated with the relationship between perception of harm and the use of e-cigarettes, results on the association showed that e-cigarettes are a safer alternative to traditional cigarettes, decreasing the harm perception. Research also showed that there are some positive/negative health events associated with using e-cigarettes, which may influence an individual's decision to switch tobacco delivery devices. Negative social influences, such as peer pressure may also encourage tobacco initiation in teens. Limited information has been collected in determining how effective current tobacco programs are.

The ASE theory was selected as the theoretical guide that focused on the fact that attitude, social influence, and self-efficacy variables can be influenced by social interaction and education techniques. I conducted a quantitative research study that used data previously collected by DSHS.

In this chapter, I described the need to understand if e-cigarettes are perceived as harmful to Texas adolescents and how this perception may be influenced by antitobacco programs. Limited information is known about e-cigarettes, so it is imperative that research is conducted to learn more on the matter. In Chapter 2, I will review the background of tobacco use and health disparities associated with using tobacco, effects of tobacco use in the adolescent population, the start of e-cigarettes, and the current

knowledge about harm and benefits of using e-cigarettes. Sample size, data collection method, instrumentation, data analysis, validity, and ethical issues will be discussed in Chapter 3. Chapter 4 will review results in relation to the research question. Chapter 5 will provide a summary of findings, limitations, recommendations for future research, and implications for practice.

Chapter 2: Literature Review

Limited research has been conducted on the health effects using e-cigarettes. Furthermore, the health effects associated with adolescent use is unknown. For this study, I used quantitative methods to determine the adolescent perception of harm of e-cigarettes and its association to state and school-based antitobacco prevention programs. This chapter reviews literature on e-cigarette use, marketing, and regulation of e-cigarettes, perception of harm from its use with an emphasis on current tobacco programs in Texas.

Literature Search Strategy

In this literature review, peer-reviewed articles from EbscoHost, Google Scholar, Medline, and CINAHL Plus were used to find relevant articles with the following search terms: *Electronic cigarettes, smoking, tobacco use, adolescent e-cigarette use, tobacco use and morbidities, tobacco cessation, perception and health effects of use, tobacco legislation, marketing of electronic cigarettes, attitude-social influences-self-efficacy theory, second hand smoke, prevalence of tobacco use,* and *tobacco health concerns*. The inclusion criteria were English language articles published in the last 5 years while excluding articles pertaining to e-cigarettes due to the lack of current knowledge and the theory of ASE. The major sections of this chapter review the history of e-cigarettes, prevalence of use, marketing, perceptions, regulation, health concerns, and smoking cessation.

Background of Electronic Cigarettes

E-cigarettes are electronically manufactured tobacco related devices that are designed to simulate traditional cigarettes (American College of Cardiology, 2019). Patented in the early 2000s by a Chinese pharmacist, e-cigarettes have increased in popularity around the world within the last decade (Franck, Budlovsky, Windle, Filion, & Eisenberg, 2014; Grana, Benowitz, & Glantz, 2014). The prevalence of e-cigarette use is increasing. In 2013, e-cigarette sales were nearly $1.8 billion (Giovenco, Lewis, & Delnevo, 2014). In the United States, sales of e-cigarettes triple every year (Czoli, Hammond, & White, 2014). They are deemed to be a healthier and a less expensive alternative to traditional cigarettes (Franck et al., 2014; Grana, Benowitz, et al., 2014). The device consists of an electronic heating component, a plastic tube, and a liquid concentration of propylene glycol, flavoring, and typically nicotine (Franck et al., 2014). The liquid concentration is heated into an aerosolized vapor as the user inhales from the mouthpiece (Franck et al., 2014). E-cigarettes can be purchased as either a disposable or rechargeable device (Franck et al., 2014).

Prevalence of Electronic Cigarettes

Prevalence in Adults

Prevalence of e-cigarettes use doubled in the United States from 3% in 2010 to 6% in 2011 (Ramo et al., 2015). Among current smokers, e-cigarette use has more than doubled from 2010 to 2011, from 10% to 21% (Ramo et al., 2015). For 2012 and 2013, subpopulations of current e-cigarette users have increased even more. Caucasians (2.2%),

college graduates (1.3%), southern state residents (2.3%) and current cigarette smokers (9.4%) reported also being e-cigarette users (King, Patel, Nguyen, & Dube, 2015).

Prevalence in Youth

E-cigarette use is on the rise in the youth-aged population of the United States (Carroll-Chapman & Wu, 2014). Between 2011 and 2012, the use of e-cigarettes by youth in middle and high school more than doubled from 3% to 7% (Ramo et al., 2015). According to data collected from the 2012 NYTS, a large portion of teens who use e-cigarettes have never used traditional cigarettes (Carroll-Chapman & Wu, 2014). Approximately 10% of teenagers have tried e-cigarettes and more than 9% of high school students who have never smoked have tried the device (Babineau, Taylor, & Clancy, 2015; Carroll-Chapman & Wu, 2014). The prevalence is higher for the younger middle school students with more than 20% have tried an e-cigarette, and nearly 40% being considered current users (Carroll-Chapman & Wu, 2014). In 2012, 2.8% of high school students considered themselves current e-cigarette users, and 2.2% were considered as dual users (Carroll-Chapman & Wu, 2014). It is unknown how tempting e-cigarette products are to the younger generation, but there is concern that it will become the gateway drug to traditional tobacco products (Carroll-Chapman & Wu, 2014). Race/ethnicity and gender also influenced the prevalence of e-cigarette use in minors. Caucasian students were more likely to know more about e-cigarettes compared to Hispanic/Latino students (71% to 51% respectively) (Carroll-Chapman & Wu, 2014). Males are more likely to use e-cigarettes when compared to females (Carroll-Chapman &

Wu, 2014). It is imperative that more focus is placed on prevalence in youth to discourage use.

Prevalence in Texas

Adults. In 2015, 17.2% of Texas adults admitted to trying or being current users of e-cigarettes (DSHS, 2017). Texas males were nearly four times more likely to use e-cigarettes compared to females (DSHS, 2017). Adults age 18-29 have a higher prevalence of use, with 34% considering themselves current users (DSHS, 2017). Current smokers also have a higher prevalence of e-cigarette use at nearly 61% compared to former or never users of tobacco products (DSHS, 2017).

Adolescents. In 2016, 25.4% of Texas middle and high school students admitted to having used e-cigarettes (DSHS, 2017). Of those, high school students had a higher prevalence at 35% compared to middle school students at 12% (DSHS, 2017). Prevalence of e-cigarette use was also like use of traditional tobacco products between middle and high school students (DSHS, 2017).

Dual Use

In 2012, 76% of individuals who were considered current e-cigarette users also used traditional cigarettes (Cataldo, Petersen, Hunter, Wang, & Sheon, 2015; Ramo et al., 2015). There is limited information on the dual use of electronic and conventional cigarettes. According to Wagener, Siegel, and Borrelli (2012), majority of e-cigarette users (79%) use e-cigarettes exclusively or as a partial replacement (17%) to traditional cigarettes.

Secondhand Smoke Exposure

Passive smoking or SHS exposure results from a user inhaling the toxic mixture released from a cigarette then exhaling the smoke into the environment (Czogala et al., 2013). Though diluted once exhaled, individuals exposed to SHS are typically exposed for prolonged periods of time (Czogala et al., 2013). SHS exposure results in more than 600,000 deaths each year (Czogala et al., 2013). Approximately 40% of children around the world are exposed to SHS (Czogala et al., 2013). Current tobacco laws and regulations do little to protect vulnerable populations from exposure to SHS.

Limited information is known about the SHS exposure from e-cigarettes. Though e-cigarettes may not emit nicotine in the air like traditional cigarettes, the e-cigarette user can exhale particles from the vaping device (Czogala et al., 2013). Some studies conducted to investigate emissions related to e-cigarette vapor has shown that the exhaled vapor may release nicotine and other volatile compounds (Czogala et al., 2013). With the increased popularity of e-cigarette use, further investigation is needed to determine what effect e-cigarette vapor has on nonusers.

Health Concerns of Electronic Cigarettes

With the limited amount of information known on e-cigarettes, the topic of health concern is still under dispute. One issue of concern is the accidental poisoning of liquid nicotine in children. Some e-cigarette devices contain a refillable tank. According to a recent report, one tablespoon of e-cigarette liquid can kill four children with smaller dosing causing severe nausea, vomiting, seizures, cardiac arrest, or even comas (Frey & Tilburg, 2016). From 2010 to 2014, reports of exposures to e-cigarette liquid in kids

increased from 271 to 3,783 (Frey & Tilburg, 2016). One factor that is increasing poisoning exposure is the ease of access to the packaging. In January 2016, the Child Nicotine Poisoning Prevention Act of 2015 was signed into law (Child Nicotine Poisoning Prevention Act of 2015, 2016). The law requires special packaging for all liquid nicotine products in accordance with the Consumer Product Safety Commissions' policies (Child Nicotine Poisoning Prevention Act of 2015, 2016). Before the federal law went into effect, some states enacted or passed legislation that required manufacturers to have childproof liquid nicotine containers. As of 2015, less than half of the United States have enacted their laws of e-cigarette liquid packaging (Frey & Tilburg, 2016).

Another issue of concern is the claim that e-cigarette liquid contains little or no trace of nicotine and/or carcinogens like traditional cigarettes. Though at various concentrations depending on the manufacturer, e-liquids typically contain propylene glycol and/or vegetable glycerin, nicotine, and water (Famele et al., 2014). Some companies even claim that the water vapor emitted from the electronic device are harmless (Nguyen, Tong, Marynak, & King, 2017). Scientific evidence shows that the aerosol vapor emitted from e-cigarettes might expose nonusers to harmful chemicals (Nguyen et al., 2017). With no federal regulation, manufacturers claim to mislabel the product to not include impurities and other toxic substances (Bertholon et al., 2013). Though the FDA now controls all aspects of e-cigarettes, including labeling of ingredients, child safety caps, and warning statements, some laws did not go into effect until November 2018 (FDA, 2018a). Nicotine found in the liquid also contains substances such as anabasine, myosmine, cotinine, anatabine, and beta-nicotyrine (Hajek, Etter,

Benowitz, Eissenberg, & McRobbie, 2014). Continued focus should be placed on determining what health concerns are associated with e-cigarette use.

Explosions and fires credited to the lack of mechanical safety of e-cigarettes is also a concern. According to a report by McKenna (n.d.), numerous fires are attributed to e-cigarettes. From 2009-2014, 25 fire incidents were found to be the result of e-cigarettes (McKenna, n.d.). Majority of incidents occurred while charging the device while other incidents occurred during use or while being carried (McKenna, n.d.). Though no injuries have resulted in death, several buns have been reported and some serious injuries when the device exploded inside users' mouth (McKenna, n.d.; Shastry & Langdorf, 2016).

Another major concern for e-cigarette consumption is the purity of ingredients manufactured in e-cigarette liquid cartridges. Limited information is known about the existence of toxins or carcinogens found in e-cigarette devices. This could be due to the fact that there is no standard for manufacturers, and there is no regulation of product labeling by the FDA (Famele et al., 2014). The liquid cartridges contain various amounts of nicotine, water, and vegetable and/or propylene glycol. Various chemicals are then added to produce flavoring and aromas. The liquid combustion will cause a chemical reaction, thus creating new, potentially harmful carcinogens (Famele et al., 2014). One study found toxins such as formaldehyde, acetaldehyde, and acetone in the liquid (Uchiyama, Ohta, Inaba, & Kunugita, 2013). In a lab analysis conducted by the FDA, products were found to have various nicotine amounts including those labeled as nicotine-free and diethylene glycol which is considered toxic to humans (Wollscheid & Kremzner, 2009). The safety of e-cigarette consumers must become a priority for

manufacturers. It is imperative that more focus is placed on device regulation to ensure the health and wellness of consumers.

Adolescent Health Concern

One major health concern of e-cigarette use in adolescents is the effects on brain development. In adolescents, the brain has yet to reach full development, and the exposure to nicotine may result in negative health effects such as mood disorders, nicotine addiction, and increased impulsivity (DHHS, n.d.). Use of e-cigarettes in teens may result in dual use of tobacco products or the initiation of other drugs such as marijuana and alcohol (DHHS, n.d.). With the increased prevalence of e-cigarettes in youth, it is important to understand how consumption affects the health of teens.

Perception of Electronic Cigarettes

Perception is the foundation for attitudes and helps determine an individual's health beliefs and can influence decision making (Gibson et al., 2018). Perception includes an individual's theory about both positive and negative outcomes that result from a performed action (Gibson et al., 2018). For example, nonsmokers perceive that cigarettes have a higher health risk than smokers, which result in the likelihood of less use of cigarettes by nonsmokers.

E-cigarettes are marketed as a safer alternative to conventional cigarettes, which could possibly change user perception of the device. Since long term effects are unknown, current research study results may be inaccurate. In one study, researchers found that more people believed that e-cigarettes are more useful in eliminating harmful effects compared to individuals who believed that they are more harmful (Martinez-

Sanchez et al., 2015). Among those aware of e-cigarettes, 52.9% reported they were less harmful and 26.4% less addictive than tobacco. Those perceiving e-cigarettes as less harmful or addictive than traditional cigarettes had the highest prevalence of use (Carroll-Chapman & Wu, 2014). More focus should be placed on determining what factors influence an individuals perception to encourage or discourage use of e-cigarettes.

Potential Harm Versus Benefits of Electronic Cigarettes

A large amount of research considers the potential benefits of e-cigarettes to outweigh the harmful effects. Though the benefits are unproven, the unknown effects are not decreasing the use of a potentially harmful product. One potential harmful issue associated with e-cigarettes is that they may encourage smoking rather than discourage it (Lam, Nana, & Eastwood, 2014). There is also concern that use of e-cigarette devices will decrease smoking cessation (Lam et al., 2014). Incomplete and incorrect labeling from the manufacturer is also a concern (Lam et al., 2014). Due to a lack of regulation standards, some products are falsely packaged as nicotine-free when they actually contain nicotine (Hajek et al., 2014**).** Some studies have found that use of e-cigarettes may increase heart rate and airway resistance (Hajek et al., 2014). With the lack of regulation, it is difficult to categorize if e-cigarettes are more harmful or beneficial to those that consume them.

Little is known about the potential benefits that could occur from the use of e-cigarettes. E-cigarettes are deemed less harmful than traditional cigarettes, thus increasing consumer use (Pokhrel, Herzog, Muranaka, & Fagan, 2015). Hajek, Etter, Benowitz, Eissenber, and McRobbie (2014) showed that short term use of e-cigarettes

does affect cardiovascular function. E-cigarette use also decreases withdrawal symptoms from traditional smoking and has no acute change in lung function (Hajek et al., 2014). Polosa et al. (2014) found that individuals with asthma who switched from traditional to e-cigarettes resulted in improved lung function. Though e-cigarettes contain small amounts of toxins such as those found in traditional cigarettes, the toxin levels are similar to nicotine replacement therapy (NRT) and lower than in tobacco smoke (Goniewicz, Lingas, & Hajek, 2012).

Marketing of Electronic Cigarettes

E-cigarette advertisements involve promoting the product via visual, print, audio, and audio-visual formats (Pokhrel, Fagan, Kehl, & Herzog, 2015). In previous years, young adults age 18-25 have been the main target of tobacco advertising because they show the highest prevalence of cigarette use (34%) in the United States (Pokhrel, Fagan, et al., 2015). The higher rate may be attributed to the change in lifestyle for young adults (Pokhrel, Fagan, et al., 2015). In 2013, more than half of the United States adult population have been exposed to some method of e-cigarette advertisement (Pokhrel, Fagan, et al., 2015). From 2011 and 2012, e-cigarette advertising from tv, newspapers, and magazines increased from $6.4 million to $18.3 million in 2012 (Kim, Arnold, & Makarenko, 2014; King et al., 2014). This number increased to more than $115 million in 2014 (Truth Initiative, n.d.). By 2024, it is estimated that sales from e-cigarettes will gross $18.16 billion (Carr, 2014).

Use of e-cigarettes is considered a healthier alternative to traditional smoking and is considered socially acceptable (Cataldo et al., 2015). Before e-cigarettes, tobacco

companies marketed tobacco products for older adults (Cataldo et al., 2015). For more than 40 years, tobacco products have been banned from public advertising (Cataldo et al., 2015). E-cigarette companies now use celebrities in their marketing strategies to normalize smoking to the public (Grana, Benowitz, et al., 2014; Voigt, 2015). The lack of regulation of e-cigarettes has now reopened the door to reverse the harmful tobacco message that has been a primary focus in public health.

The main marketing strategy of tobacco companies is to renormalize the use of e-cigarettes in the public eye. Researchers showed that tobacco advertising is directly related to tobacco use (Cataldo et al., 2015). E-cigarettes imitate the look and feel of using a traditional cigarette for smoking (Cataldo et al., 2015). Due to the lack of regulation, tobacco companies are capitalizing the use of e-cigarettes in public places like restaurants or hospitals where conventional cigarettes are banned (Grana, Benowitz, et al., 2014).

Another marketing strategy tobacco companies are using to target younger individuals is to provide e-cigarette devices in various colors, designs, and flavors (Carr, 2014). Flavored conventional cigarettes were banned by the FDA in 2009 however, e-cigarettes are offered in various flavors like strawberry, bubblegum, peach cobbler, apple banana, chocolate, vanilla, and red bull among other flavors (Carr, 2014). Increased marketing targeting youth continue to make use to e-cigarettes enticing.

Tobacco companies consider e-cigarettes as a safe and smokeless alternative to conventional cigarettes (Cataldo et al., 2015). They are also considered to aid in smoking cessation (Cataldo et al., 2015). These claims are not yet proven. Grana and Ling (2014)

showed that online, e-cigarettes are marketed as a cheaper alternative to cigarettes that do not produce SHS and can be used anywhere regardless of current smoking bans.

Regulation

The Family Smoking Prevention and Tobacco Control Act of 2009 authorized the FDA the authority to recommend requirements and restrictions for the manufacturing, distribution, and marketing of tobacco-related products (King, Alam, Promoff, Arrazola, & Dube, 2013). In August 2016, the regulation extended to include all tobacco products, including e-cigarettes (FDA, 2016b). Under this act, the FDA restricted marketing and sales of tobacco to minors, required warning labels on smokeless products, and required disclosure of tobacco ingredients (FDA, 2018b). Although the FDA has allowed e-cigarettes to be sold as a tobacco product, it does not allow them to be marketed as a therapeutic product (Franck et al., 2014; King et al., 2013). Before regulation, most brands were marketed as lower-cost, tobacco-free alternatives to conventional cigarettes that were not subject to regular smoking laws and thus could be used in typically nonsmoking areas (Franck et al., 2014). Though it is possible that some tobacco products can have less harmful effects than others, current regulation and marketing standards will be based on the existing scientific data (FDA, 2016b).

E-cigarette products must now include warning statements on all packaging and advertisements (FDA, 2019). New regulations also prohibit the use of any labeling that may be false or misleading to the consumer (FDA, 2018a). Products must also contain a list of ingredients and manufactures are restricted from advertising and promoting tobacco products, including e-cigarettes, to adolescents (FDA, 2019)

Other countries have restricted the sale of e-cigarettes due to the unproven scientific claims that they are a harm reduction agent (Franck et al., 2014). Canada requires nicotine e-cigarettes to have scientific evidence that proves quality, safety, and efficacy for the intended use (Franck et al., 2014). Since no evidence has definitively concluded these results, nicotine e-cigarettes are prohibited for sale in Canada (Franck et al., 2014). Countries such as Denmark, New Zealand, Austria, and Britain are regulating e-cigarettes as medication, while countries like Brazil, Singapore, and Norway have banned e-cigarettes entirely (Franck et al., 2014).

Sale to Minors

Traditional nicotine products are prohibited of being sold to minors. However, millions of children had access to purchase e-cigarettes due to the lack of laws prohibiting sales to minors. Before the 2016 regulation, more than 16 million children under the age of 18 could legally purchase e-cigarette products due to the lack of laws with only 40 states limiting the sale to minors in the United States (Marynak et al., 2014). Under the new law, individuals under 18 years of age are prohibited from purchasing tobacco (FDA, 2016b).

In 2012, it was reported that one million adolescents purchased tobacco products online (Williams, Derrick, & Ribisl, 2015). This is done by avoiding the age verification of Internet Tobacco Vendors (ITV) (Williams et al., 2015). In a study of ITV's by Williams, Derrick, and Ribisl (2015), results showed that 75% of youth who tried to buy e-cigarettes online were successful. This proves that if adolescents tried to purchase e-cigarette products online, they would be successful. Some states require ITV to use an

age verification system, however ITV's either do not comply or use an ineffective system (Williams et al., 2015).

Taxes

Another regulation concern with e-cigarettes is the lack of sales tax implemented on these products. The majority of the United States do not currently tax e-cigarette products (Mainous, Tanner, Mainous, & Talbert, 2015). Taxation is used as method to decrease tobacco demand and consumption (Mainous et al., 2015). Currently, e-cigarettes are only subjected to the sales and use tax in Texas (Texas Comptroller of Public Accounts, n.d.). They do not meet the definition for cigarette tax because they do not contain tobacco as an ingredient. (Texas Comptroller of Public Accounts, n.d.) Without taxes or regulation, e-cigarettes are an attractive alternative to traditional cigarettes, thus promoting use.

Debate Over Health Effects of Electronic Cigarettes

In reviewing the literature associated with the relationship between the use of e-cigarettes and various health effects, researchers showed that though e-cigarettes may be a safer alternative to traditional cigarettes, they are not without concern of their own (Rom, Pecorelli, Valacchi, & Reznick, 2015). Researchers also showed both positive and negative health events associated with using e-cigarettes, which may influence an individual's decision to switch tobacco delivery devices (Hua, Alfi, & Tabot, 2013). Limited research has been conducted on what health effects or benefits would persuade a young person to use e-cigarettes.

Hua, Alfi, and Talbot (2013) provided information on both positive and negative outcomes of using e-cigarettes, though negative outcomes were considered minor compared to traditional cigarette effects. The authors also supported that online data collection methods are beneficial to use in this community. Tan and Bigman (2014) concluded that the majority of individuals who use e-cigarettes have the perception that they are a safer alternative to traditional cigarettes, though at a decline from results from previous studies. Individuals who used e-cigarettes perceived them as less harmful to their traditional cigarette counterparts (Sutfin, McCoy, Morrelld, Hoeppner, & Wolfson, 2013; Tan & Bigman, 2014). Since no combustion occurs, the inhalation of nicotine through an e-cigarette is believed to be a safer alternative to cigarette smoking by eliminating the inhalation of harmful compounds, including tar and carbon monoxide (Franck et al., 2014). Further research is necessary to conclude the health effect debate of e-cigarettes.

Texas Tobacco Economics

The health-related costs associated with tobacco-related death and disease has a detrimental impact on the economy. The healthcare-related cost of smoking in Texas results in $8.85 billion each year (Campaign for Tobacco-Free Kids, 2019.). Medicaid costs caused by smoking-related illnesses cost Texans $1.96 billion annually while each household has a tax burden of $747 each year to cover the expenses (Campaign for Tobacco-Free Kids, 2019). Loss of productivity cost $8.22 billion annually (Campaign for Tobacco-Free Kids, 2019). In Texas, 28,000 adults die each year from smoking-related illnesses while an estimated 498,000 adolescents that are currently under age 18

will die prematurely from smoking (Campaign for Tobacco-Free Kids, 2019). Nearly 27% of cancer-related deaths in Texas are attributed to smoking (Campaign for Tobacco-Free Kids, 2019). Smoking causes a heavy economic burden across the world. It is imperative that public health officials create strategies to decrease the burdens associated with premature death and disease related to tobacco use.

Use of E-Cigarettes as a Smoking Cessation Device

Pokhrel, Fagan, et al. (2015) claimed that e-cigarettes are comparable to NRT due to the fact that both deliver nicotine and can be purchased over the counter. However, limited information is known about how successful e-cigarettes are as a form of NRT. Pokhrel, Fagan, et al. (2015) were able to determine that younger individuals were more likely to use e-cigarettes as NRT compared to older adults (Pokhrel, Fagan, et al., 2015).

Bullen et al. (2013) focused on determining if using e-cigarettes is more effective than nicotine patches for smoking cessation. They proved that both nicotine and placebo e-cigarettes are effective in smoking cessation (Bullen et al., 2013). Though effective, Bullen et al. also concluded that e-cigarettes were no more effective than nicotine patches. Siegel, Tanwar, and Wood (2011) also concluded that e-cigarettes were effective in cessation. Some users maintained smoke-free status 6 months after the study's conclusion (Siegel et al., 2011). Though some researchers have found e-cigarettes to be a successful smoking cessation device, more research is still needed to determine if the benefits as a cessation device outweigh the harm of use.

Texas Tobacco Control Initiatives

The mission and goal of the DSHS Tobacco Prevention and Control unit is to reduce the health and economic effects associated with tobacco use in citizens of Texas (DSHS, 2018). DSHS is responsible for creating media campaigns to educate Texans about the dangers associated with tobacco use, conducting the YTS, and partnering with Texas Tobacco Prevention and Control Coalitions (TPCC) throughout the state (DSHS, 2018). Media campaigns such as DUCK, Worth it, Spit it Out, Share Air, and Yes Quit are all designed to educate youth and young adults on the importance of tobacco prevention (DSHS, 2018).

In addition to media campaigns, DSHS provides public funding to 18 communities in East Texas to develop comprehensive programs that include high-level media campaigns that are combined with prevention and cessation programs throughout the communities (DSHS, 2017). A pilot study was conducted in the coalition areas to evaluate the effectiveness of tobacco prevention initiatives, and the results showed a 40% decline in use among sixth and seventh graders with an increase in tobacco cessation in youth and young adults (DSHS, 2017). Determining which Texas tobacco control initiatives are effective is important to understand which programs have the greatest impact in tobacco use reduction.

Attitude-Social Influence-Self-Efficacy

For this study, the ASE theory was used. The ASE theory is a widely used social-cognitive theory for understanding adolescent smoking prevention (Bidstrup et al., 2010). The ASE theory was designed by Hein de Vries and combined the Theory of Planned

Behavior (TPB) and the social cognitive learning theory (SC/LT) (Bidstrup et al., 2010). The decision to experiment with smoking is influenced by attitude, self-efficacy, and social influence (Bidstrup et al., 2010).

To understand the ASE theory, there must be an understanding of the TPB and the SC/LT. The TPB is a modification of the theory of reasoned action created by Ajzen (Petraitis, Flay, & Miller, 1995) and is one of the most commonly applied theories to study health-related behavior (Vitoria, Salgueiro, Silva, & Vries, 2009). TPB concluded that in addition to attitudes and normative beliefs, self-efficacy was a contributing factor in affecting one's behaviors, perceptions, and intentions (Petraitis et al., 1995). There are two forms of self-efficacy: use self-efficacy and refusal self-efficacy (Petraitis et al.,1995). Use self-efficacy is the belief that adolescents that can obtain and use substances such as tobacco are more inclined to use them while refusal self-efficacy is the belief that adolescents can resist the social pressure that influences tobacco use (Petraitis et al., 1995). Created by Bandura, the SC/LT argues that adolescent beliefs are developed and influenced by the role models they are exposed to such as close friends, parents, or teachers (Petraitis et al., 1995). SC/LT also includes the concept of self-efficacy and suggests that role models can either have a positive or negative effect on one's self-efficacy (Petraitis et al., 1995).

The ASE theory suggests that attitude, social influence, and self-efficacy variables can be persuaded via specific health promotion activities (Babirye et al., 2011; Vitoria et al., 2009). However, the ASE theory is more beneficial in explaining the social influences that can predict current behavior (Twinomujuni, Nuwaha, & Babirye, 2015). Controlling

the use of tobacco products is effectively done during adolescence and by promoting prevention programs, such as those offered in Texas public schools (Vitoria et al., 2009). The focus of ASE is that individuals will not start a negative health behavior, and this will be enforced by positive social influences (Vitoria et al., 2009). Vitoria, Salgueiro, Silva, and Vries (2009) found that when assessing the variables of social influence, attitude, and self-efficacy as it relates to adolescent smoking, each variable has a different influence on an adolescent's intent to use tobacco and the effects they perceive associated with its use. Bidstrup et al. (2009) were the first to take into account the group level school factor as it relates to the ASE theory. Results suggested that parents and friends who smoked had a higher influence of early adolescent use, as they have a lower risk of perception of harm, compared to friends being the major influence of adolescents who initiated use later (Bidstrup et al., 2009). In this study, researchers only partially approved the ASE theory and suggested that greater understanding of how ASE factors on the school level affect adolescent smoking, such as school prevention programs (Bidstrup et al., 2009). Researchers expanded on previous research of the ASE theory to determine if the social influences from teachers and/or health programs are providing the necessary knowledge and skills necessary to overcome e-cigarette use. Understanding the factors associated with the ASE theory as it relates to e-cigarette use may be beneficial in understanding why adolescents start using tobacco products.

Summary

In summary, this chapter reviewed (a) the history of e-cigarette use; (b) prevalence of tobacco use; (c) tobacco legislation; (d) marketing; (e) e-cigarette health

concerns; (f) perception of e-cigarette use and; (g) smoking cessation using e-cigarettes. The results from this study increased the knowledge about the perception of health outcomes of adolescents using e-cigarettes and the effectiveness of current antitobacco campaigns. Chapter 3 will involve the design of the study, eligibility criteria for participants, instrumentation description, sampling method, data collection procedures, data analysis, and ethics of participants.

Chapter 3: Research Method

This secondary, nonexperimental study focused on determining the association between use of e-cigarettes, exposure to state and public school antitobacco initiatives, and the perception of harm among Texas adolescents. E-cigarettes are becoming increasingly popular in the United States (Dutra & Glantz, 2014). Little research has been done to effectively conclude if e-cigarettes are perceived as harmful or beneficial (Bertholon et al., 2013) or if current antitobacco campaigns are effective in adolescents.

Tobacco use is attributed as the leading cause of premature disease and death in the United States and worldwide (Drummond & Upson, 2014; King et al., 2012). It is considered a risk factor for the leading cause of death associated with heart disease, lower respiratory infections, COPD, cerebrovascular disease, tuberculosis, and lung cancer (Drummond & Upson, 2014). In the United States alone, an estimated 443,000 adults die annually due to the use of cigarettes (King et al., 2012). Of those, more than 49,000 adults die due to complications of SHS (King et al., 2012). At the current rate of tobacco initiation, an estimated 5.6 million of today's youth will die prematurely from a smoking-related illness (DHHS, CDC, National Center for Chronic Disease Prevention and Health Promotion 2014).

E-cigarettes are marketed as a safer alternative to conventional cigarettes, which could possibly change user perception of the device (Lozano et al., 2019). Those who consider e-cigarettes as a safer alternative may be more inclined to use the product. Due to the fact that long term effects are unknown, current research study results may be inaccurate.

The importance of this study was to provide an understanding of how adolescents perceive the harm associated with the use of e-cigarettes and how this perception is influenced by state and public school antitobacco initiatives. My study results provided an understanding of the public health effects related to perception of harm of using e-cigarettes. Results from this study also provided information on the effectiveness of current school and state antitobacco programs on adolescents across Texas. This chapter describes the research design, methodology, sampling procedure, recruitment procedures, instrumentation, data analyses, reliability, validity, and ethical protection of participants.

Research Design and Rationale

A quantitative research design method was used to examine participants perception of harmful effects associated with the use of e-cigarettes and its relationship to being exposed to state and public school antitobacco campaigns. The study was a cross-sectional, secondary data set disseminated randomly to Texas middle and high school students. Ordinal logistic regression (OLR) was used to determine if one or more of the independent variables influences the outcome variable. The independent variables were e-cigarette use, exposure to state antitobacco programs, and exposure to school-based antitobacco activities. The dependent variable was perception of harm. Gender, age, race, ethnicity grade level, SES, and area of residence were used as potential covariates.

A cross-sectional research design was selected for this study. Cross-sectional studies are designed to determine prevalence within a population at a specific point in time (Mann, 2003). Prevalence is defined as the number of cases of a diagnosis in a population at any given time (Mann, 2003). Analytical cross-sectional studies are used to

compare outcomes among those who are exposed to those who are not exposed (Mann, 2003). My goal was to determine if adolescents who use e-cigarettes or are exposed to e-cigarettes perceive its use as harmful and if their perception is influenced by exposure to state and public-school antitobacco initiatives.

An advantage to using cross-sectional studies in research is that it limits ethical concerns since subject participants are not deliberately exposed to the agent (Mann, 2003). This research method is designed to determine and compare variables to each other (Mann, 2003). Cross-sectional studies are also less expensive since only one group of participants are studied, data is collected at one time, and it allows for multiple outcomes to be studied at once (Mann, 2003). This research method can be conducted faster and is beneficial in public health planning efforts.

Methodology

The Texas YTS was conducted during the spring of 2016 from a partnership with The Public Policy Research Institute (PPRI) at Texas A&M University and DSHS. DSHS funded nine coalition service areas in Texas as an effort to provide evidence-based, community-planned tobacco prevention and control efforts across regions of the state. The goal of each coalition included (a) to conduct an in-depth community tobacco needs assessment regarding tobacco use and health-related illnesses that affect Texas residents; (b) develop the capability to address the needs of the community as it relates to tobacco education and; (c) to plan, implement, and evaluate evidence-based prevention strategies to address the tobacco concerns (PPRI, 2016).

Population

Participants for this secondary study analysis were recruited randomly for participation. The primary study involved a two-step sampling design. Eligible schools were targeted or randomly selected for participation then classrooms were randomly selected from each school. Students and/or their parents had the option of declining participation in the study. Texas is home to more than 28 million people, with more than 7 million residents under the age of 18 (U.S. Census Bureau, n.d.). Public school enrollment for 2016-2017 school year totaled 5.3 million teens grades sixth through 12th (Texas Education Agency, 2017). To ensure the study participants selected accurately reflected the general population of Texas, schools were selected based on a probability sample.

DSHS funded nine coalition areas that were designed to provide evidenced-based, community-planned environment, tobacco control and prevention efforts in targeted areas (PPRI, 2016). These coalitions served as community liaison for tobacco control initiatives (PPRI, 2016). They provided tobacco prevention and control education, media efforts, and local community support (PPRI, 2016). The coalition areas originally chosen included the partnership with local universities (PPRI, 2016). Since its implementation, the county coalition areas continue to change to neighboring counties (PPRI, 2016).

Sampling and Sampling Procedures

Stratified random sampling is used when the researcher is interested in the groups within a population (Lund Research, n.d.). One advantage of using the stratified random sampling method is to reduce the chance of human bias during the selection process.

Stratified sample creates a sample that is representative of the population studied (Lund Research, n.d.). With stratified sampling, researchers can use a smaller sample size, saving time and money, and it ensures that no group is over-represented in the sample (Lund Research, n.d.). One disadvantage of using stratified sampling method is the complete list of the population must be available, which may be difficult or impossible to obtain (Lund Research, n.d.).

PPRI sampled across the state using probability proportionate to size sampling measures to ensure the probability of a school's selection is comparative to its size (PPRI, 2016). The sample size for the 2016 YTS was designed as a random sample of all public schools for students between sixth and 12th grades.

State sampled schools (noncoalition areas). State sampled schools were notified for participation via a recruitment package. Greater detail on the recruitment material is discussed in the sections below. To participate in the study, each school was asked to submit their basic participation form via fax or email. The PPRI coordinator made several attempts via phone and email to the schools to encourage participation. To ensure accurate representation of rural and border schools, the selection areas were increased while the selection for larger urban schools were decreased.

Coalition schools. All 65 school districts in the coalition area were targeted for participation. The nine service coalition areas included the following counties: Angelina and Nacogdoches Counties; Brazos County; Ellis County; Galveston County; Hidalgo County; Lamar, Red River and Rusk Counties; Nueces County; Waller County; and Wichita County. Along with the above recruitment methods, PPRI collaborated with

coalition staff members to help distribute letters of support for the survey. Coalition members were also encouraged to connect with school districts directly since they often had established contacts in these areas. Classrooms within each district school were then randomly sampled for inclusion.

Classroom sample. The PPRI coordinator randomly selected classrooms for participation. Each school was asked to provide a master list of all classes for grades six through 12. For schools who used the paper/pencil method for data collection, the coordinator selected classes either by class period or by subject where all students must be enrolled. For schools who used the online data collection method, the coordinator selected classrooms only by subjects where all students were enrolled. Once each classroom period/subject was selected for each school/district, the coordinator asked the schools to provide a list of all teachers for either the selected classroom period or subject. PPRI then randomly selected classrooms until the end number for each grade level was complete. Fewer classrooms were selected in districts with lower enrollment.

Inclusion criteria. Participants included in the study met the following criteria:

- Texas students in Grades sixth through 12.
- Voluntarily consented to participate.
- Enrolled in an eligible participant school.
- Students who received written authorization from a parent to participate.

Exclusion criteria. Participants were excluded from the study if they met one of the following criterion:

- Were not Texas students Grade sixth through 12.
- Did not voluntarily consent.
- Did not receive written authorization from a parent to participate.

Sample size. G* Power 3.0.10 was used to determine the statistical power necessary to prevent a Type II error. The entire sample size available for the study was used for data analysis. A small effect size of 0.02 will yield a high statistical power of 98%. SPSS was used to perform all data analysis calculations. I used the entire response sample size of 10,717 students, excluding participants with missing responses.

Procedures for Recruitment, Participation, and Data Collection

Researcher Access to Data

This study was a secondary analysis of a community partnered dataset collected by DSHS and Texas A&M University. Though the dataset was collected by the TX DSHS, a state government agency, the dataset was not made publicly available. Texas A&M University was asked to prepare the raw data for use. I was required to email the PPRI at Texas A&M University to receive a copy of the data (Appendix A)

School Recruitment

State sampled school recruitment. Once a school was selected for enrollment, the school principal received a survey recruitment packet that contained the following documents: (a) recruitment letter, (b) frequently asked questions and, (c) basic participation. To participate in the study, each school was asked to complete and submit the basic participation form via fax or email. Follow-up phone calls by the YTS survey

coordinator at PPRI were conducted on schools that did not complete the basic participation form to encourage participation.

Coalition sample school recruitment. Along with the methods used to recruit state schools, PPRI collaborated with coalition staff members in each service area to provide additional recruitment efforts. Coalition staff members were encouraged to reach out to the school districts to increase participation.

Data Collection Procedures

Once a school confirmed participation, classrooms were randomly selected by PPRI to participate. Each district or campus survey coordinator distributed a parental notification document to the parents of each student in a selected classroom a minimum of two weeks before the survey was conducted. Parental notification forms included the study background information, risk/benefits, voluntary withdrawal, contact information, and privacy information. After receiving signed parental notifications, the survey coordinator provided school survey administration materials for each classroom to the school coordinator. Survey materials included instructions including a manuscript for teachers to read to students and all necessary materials needed to administer the survey. Teachers administering the survey are asked to complete a classroom identification form that provided the number of students enrolled in the class, and the number of students absent the day of the study. Students who completed the survey online were provided with a unique alphanumeric survey code to access the online survey website. Once the surveys were administered they were sealed in an envelope with the classroom

identification form and returned to PPRI. Both used and unused survey tokens were also sealed in an envelope and returned to PPRI.

Each school district was offered an incentive as part of participation. Coalition school districts were offered $500 payment or provided a district level report. Noncoalition schools received a $300 payment. The financial incentive was to reimburse school districts for printing and mailing information to parents of participating students and any other expenses incurred.

Survey administration. The survey was available in either a paper/pencil format that could be scanned as well as via online administration using LimeSurvey software. Completing the survey using the paper/pencil format allowed for an anonymous, self-administration from the students with an aid of a distribution of the survey by a school staff member, reading of instructions, monitoring during the survey administration, and collection of the instrument. For online administration, students were provided with a single-use token to access the survey. Online collection did not allow for distribution and collection of the survey by school staff members. Both survey formats were offered in English and Spanish.

Instrumentation and Operationalization of Constructs

Survey instrument. The 2016 Texas YTS was developed by PPRI and DSHS. The purpose of this survey was to inform state and local-level policymakers on the level of adolescent tobacco use in Texas secondary schools (PPRI, 2016). Texas A&M University was asked to prepare the raw data for my use. This information can be found in Appendix A.

Texas YTS. The first YTS was conducted in 1998 after the Texas tobacco settlement was funded (Ahern et al., 2000). Funding was provided for tobacco education and prevention efforts and the survey was designed to see how changes in tobacco use in youth were affected by those prevention efforts (Ahern et al., 2000). The Texas YTS has been conducted every even-numbered year since 1998 (DSHS, 2009). In 2016, the Tobacco Prevention and Control Program funded nine coalitions across the state of Texas to provide evidence-based tobacco control programs created by the community (PPRI, 2016). Local school districts in each of the nine coalition areas were recruited to participate as an effort to provide a baseline for each service area. A statewide sample was also recruited collected of public schools for comparison purposes. The questionnaire received approval from both the University of Texas TPCC evaluation team and DSHS.

Reliability and validity of the survey instrument. The survey instrument used in this study is considered both reliable and valid. The YTS is used biennially within the same population (DSHS, 2009). It consistently measures what it is intended to. The original YTS was modeled after the CDC's Youth Risk Behavior Survey (YRBS) and the NYTS (DSHS, 2016). State and local agencies can modify the questionnaire to fit their intended needs (CDC, 2018b).

Though all survey instruments are considered reliable and valid, it should be noted that the instruments cannot be guaranteed with 100% certainty. Credibility of collected data can vary by age groups. The CDC (2018b) noted that for responses to be considered truthful, adolescents must perceive the study as important and understand how their privacy will be protected.

For both the 1992 and 2000 YRBS studies, two test-retest for reliability were conducted by the CDC (Brener et al., 2013). For the 1992 study, results from the test-retest indicated that majority of the survey questions were rated with a high reliability and best suited for students in grades ninth through 12th (Brener et al., 2013). For the 1999 study, the test-retest showed a significantly different prevalence during the questionnaire administration (Brener et al., 2013). The questions that were identified as unreliable were either deleted or revised for a later instrument version (Brener et al., 2013).

Validity of self-reported behaviors has not been conducted. CDC reviewed literature on situational and cognitive factors that could affect validity of self-reporting behavior in adolescents (Brener et al., 2013). In reviewing the literature, CDC determined that self-reported behavior was determined not to be affected by cognitive and situational factors, thus not threatening the validity of the instrument (Brener et al., 2013).

Description of Variables

Independent Variables. The independent variables were e-cigarette use, exposure to state antitobacco programs, and exposure to school-based antitobacco activities. These variables will be defined in the inferential analysis.

Dependent Variables. The dependent variable was perception of harm. This nominal variable will be defined in the inferential analysis.

Covariates. The following covariates were used in this study:

Age. Age is a continuous variable. Respondents had the option of entering their exact age.

Gender. Gender is dichotomous variable with the response option of male or female.

Race. Race is a nominal variable. To assess race, students had the option of selecting one of the following categories: American Indian or Alaska Native; Asian; Black or African American; Native Hawaiian or other Pacific Islander; White; more than one race.

Ethnicity. Ethnicity is a nominal variable. To assess ethnicity, students were asked if they were Hispanic or Latino and were asked to selected not Hispanic or Latino; Mexican, Mexican American or Chicano; other Hispanic or Latino. This variable was recoded to Hispanic or not Hispanic.

Grade Level. Education is an ordinal variable with the response option of 6^{th}, 7^{th}, 8^{th}, 9^{th}, 10^{th}, 11^{th}, or 12^{th} grade. Used interchangeably with grade.

Socioeconomic Status (SES). SES is a dichotomous variable. To assess SES, students were asked, "During the current school year, do you qualify for free or reduced-price school lunch?" with the response option of yes, no, or don't know.

Area of residence. Students area of residence was determined during sample size of either state sample or coalition sample. There are nine coalition areas containing 65 school districts. All remaining areas were considered state area of residence.

Data Analysis

Data Entry and Analyses

As surveys were returned to PPRI, the instruments were scanned and coded using an optical scanner. All data were recorded using statistical software that allowed for

analysis and tables that can be automatically generated based on requests. For my analysis, SPSS was used to perform all calculations. The sample size was weighted to ensure that responses adequately represent the state population.

During the collection process, no personal identifiers were collected. To increase confidentiality of individual students, groups with less than 10 responses were removed from analysis. When a grade level was missing in a survey, PPRI estimated the students grade based on the age provided. Table 1 shows the age-based grade assignments PPRI used to input missing data.

Table 1

Age-Based Grade Assignments

Age	Grade Level
11	6th Grade
12	7th Grade
13	8th Grade
14	9th Grade
15	10th Grade
16	11th Grade
17 or older	12th Grade

Note. From 2016 Texas Youth Tobacco Survey Methodology Report by Public Policy Research Institute at Texas A&M University, Texas Department of State Health Services, 2016. Reprinted with permission.

Quality control measures. To ensure quality, PPRI conducted numerous internal quality control checks to guide the survey process. A quality control analyst was used to oversee the pre/post analysis quality control process. Responsibilities included monitoring and tracking each school districts survey and ensuring that all surveys were properly coded and scanned and that abnormalities were avoided. There were also procedural quality control checks implemented. Each survey instrument was coded with a five-digit litho-code scannable number when printed. This ensured that if the surveys

were placed out of order when scanned, the correct survey would be recorded in the correct record. Additionally, researchers conducted a physical audit check of 10% of surveys to verify the number counted by hand equaled the number counted by the scanner.

Ordinal Logistic Regression

The data collected during the study was analyzed using SPSS statistical software to determine the perception of harm of e-cigarettes and its relationship to exposure of state and/or public school antitobacco campaigns. This cross-sectional study used OLR to determine which covariates and interactions terms influenced how Texas adolescents perceive the harmfulness of e-cigarettes. OLR determined the relationship between the independent variables and the ordinal dependent variable stratified by potential covariates for age, gender, race, ethnicity, grade level, SES, and area of residence. The dependent variable, perception of harm, was assessed by using the following YTS question:
How dangerous do you think it is for a person your age to use e-cigarettes, also called e-cigarettes, vape pens, e-hookah, hookah pens, and e-cigars such as NJOY, Blu, or Logic? Response options were very dangerous, somewhat dangerous, not very dangerous, or not dangerous at all. I interpreted that perception of harm would be defined using the 4-level likert scale response options.

Test for confounding. To test for potential confounding, data was analyzed using linear regression, OLR, and chi-square. All independent variables were found to have a statistically significant correlation to the dependent variable. For research questions 1-3, gender (female), grade levels sixth through eighth, and Asian tested significantly as

confounders. All other variables were determined not to be confounders. Logistic regression was used to control for multiple confounders. Results for confounding are provided in Chapter 4.

Test for interaction. OLR was used to test for the presence of interaction between the categorical variables for research questions 1-3. Each research question was analyzed to determine if age, race, gender, ethnicity, or grade level were interactions. For research question 1, gender (female), grade levels sixth through eighth, and Asian tested significantly as interactions. For research question 2, gender (female), sixth grade, and more than one race tested significantly as interactions. For research question 3, gender (female) and sixth grade tested significantly as interactions. Results for interactions are provided in Chapter 4.

Interpretation of results. All analyses were interpreted using a Beta, Wald x^2, *p* value, Odds Ratio (Expβ), and a 95% Confidence Interval (CI). Beta is the probability of a Type II error or failing to reject a false null hypothesis occurring. The Wald x^2 determines the significance of the explanatory variables. The lower the beta, the less chance of a type II error. Odds Ratio is used to measure the association between the independent and dependent variables. An odds ratio that results in greater than one increases the occurrence of an event while an odds ratio less than one decreases the occurrence of the event. In interpreting *p* value, anything with a value at or below 0.050 is considered significant. The 95% CI for the odds ratio determines that the values of the odds ratio are true 95% of the time. If the CI does not contain a one in the value, the *p* value will be less than 0.050

Research Question

RQ1: What is the relationship between e-cigarette use and perception of harm among Texas adolescents?

$H_0$1: There is no relationship between e-cigarette use and perception of harm among Texas adolescents.

H_a1: There is a relationship between e-cigarette use and perception of harm among Texas adolescents.

RQ2: How does exposure to state antitobacco programs influence the perception of harm of e-cigarette use in Texas adolescents?

$H_0$2: Exposure to state antitobacco programs does not influence the perception of harm of e-cigarette use in Texas adolescents.

H_a2: Exposure to state antitobacco programs does influence the perception of harm of e-cigarette use in Texas adolescents.

RQ3: How does exposure to school-based antitobacco activities influence the perception of harm of e-cigarettes in Texas adolescents?

$H_0$3: Exposure to school-based antitobacco programs does not influence the perception of harm of e-cigarette use in Texas adolescents.

H_a3: Exposure to school-based antitobacco programs does influence the perception of harm of e-cigarette use in Texas adolescents.

RQ4: How does the relationship between e-cigarette use and perception of harm differ based on area of residence (state vs. coalition resident) in Texas adolescents?

$H_0$4: There is no relationship between e-cigarette use and perception of harm based on area of residence (state vs. coalition resident) in Texas adolescents.

H_a4: There is a relationship between e-cigarette use and perception of harm based on area of residence (state vs. coalition resident) in Texas adolescents.

RQ5: How does the relationship between e-cigarette use and perception of harm differ based on socioeconomic status in Texas adolescents?

$H_0$5: There is no relationship between e-cigarette use and perception of harm based on socioeconomic status in Texas adolescents.

H_a5: There is a relationship between e-cigarette use and perception of harm based on socioeconomic status in Texas adolescents.

Inferential Analyses

RQ1: What is the relationship between e-cigarette use and perception of harm among Texas adolescents?

The independent variable, e-cigarette use, was assessed by using the following YTS question:

Survey Question 14d: Have you ever tried using electronic cigarettes, also called e-cigarettes, vape pens, e-hookah, hookah pens, and e-cigars such as NJOY, Blu, or Logic?

The dependent variable, perception of harm, was assessed by using the following YTS question:

Survey Question 27e: How dangerous do you think it is for a person your age to use electronic cigarettes, also called e-cigarettes, vape pens, e-hookah, hookah pens, and e-

cigars such as NJOY, Blu, or Logic? Response options were very dangerous, somewhat dangerous, not very dangerous, or not dangerous at all.

RQ2: How does exposure to state antitobacco programs influence the perception of harm of e-cigarette use in Texas adolescents?

The independent variable, exposure to state antitobacco programs, was assessed by using the following YTS question:

Survey Question 34a-e: During the past 12 months, which of these antitobacco advertisements or events have you seen or taken part in (in reference to the following advertisements or events): an ad with a DUCK that said *Tobacco is foul*; an ad that asks if tobacco is *Worth it*; an ad about the effects of smokeless tobacco (*Spit it Out)*; participated in a DUCK event where [they] learned different ways to say no to tobacco; an antitobacco advertisement or taken part in an antitobacco event not listed above. Response options were yes or no.

The dependent variable, perception of harm, was assessed by using the following YTS question:

Survey Question 27e: How dangerous do you think it is for a person your age to use electronic cigarettes, also called e-cigarettes, vape pens, e-hookah, hookah pens, and e-cigars such as NJOY, Blu, or Logic? Response options were very dangerous, somewhat dangerous, not very dangerous, or not dangerous at all.

RQ3: How does exposure to school-based antitobacco activities influence the perception of harm of e-cigarettes in Texas adolescents?

The independent variable, exposure to school-based antitobacco activities, was assessed by using the following YTS question:

Survey Question 32: During the past 12 months, have you participated in any school-based antitobacco activities to discourage people your age from using cigarettes, chewing tobacco, snuff, or dip? Response options were yes or no.

Survey Question 33a-c: During this school year in reference to: did you practice in any of your classes ways to say no to tobacco (for example, in role play); were you taught in any of your classes that most people your age do not use tobacco products; has what you learned in school helped you feel it is okay to say no to friends who offer you tobacco products. Response options were yes or no.

The dependent variable, perception of harm, was assessed by using the following YTS question:

Survey Question 27e: How dangerous do you think it is for a person your age to use electronic cigarettes, also called e-cigarettes, vape pens, e-hookah, hookah pens, and e-cigars such as NJOY, Blu, or Logic? Response options were very dangerous, somewhat dangerous, not very dangerous, or not dangerous at all.

RQ4: How does the relationship between e-cigarette use and perception of harm differ based on area of residence (state vs. coalition resident) in Texas adolescents?

The independent variable, e-cigarette use, was assessed by using the following YTS question:

Survey Question 14d: Have you ever tried using electronic cigarettes, also called e-cigarettes, vape pens, e-hookah, hookah pens, and e-cigars such as NJOY, Blu, or Logic?

The dependent variable, perception of harm, was assessed by using the following YTS question:

Survey Question 27e: How dangerous do you think it is for a person your age to use electronic cigarettes, also called e-cigarettes, vape pens, e-hookah, hookah pens, and e-cigars such as NJOY, Blu, or Logic? Response options were very dangerous, somewhat dangerous, not very dangerous, or not dangerous at all.

The participants were not asked in which area they reside. I stratified the results based off where the survey was collected.

RQ5: How does the relationship between e-cigarette use and perception of harm differ based on socioeconomic status in Texas adolescents?

The independent variable, e-cigarette use, was assessed by using the following YTS question:

Survey Question 14d: Have you ever tried using electronic cigarettes, also called e-cigarettes, vape pens, e-hookah, hookah pens, and e-cigars such as NJOY, Blu, or Logic? Response options were no, never heard of, yes, or no.

The dependent variable, perception of harm, was assessed by using the following YTS question:

Survey Question 27e: How dangerous do you think it is for a person your age to use electronic cigarettes, also called e-cigarettes, vape pens, e-hookah, hookah pens, and e-cigars such as NJOY, Blu, or Logic? Response options were very dangerous, somewhat dangerous, not very dangerous, or not dangerous at all.

The covariate, SES, was assessed by using the following YTS question:

Survey Question 6: During the current school year, do you qualify for free or reduced-price school lunch? Response options were yes, no, or don't know.

Threats to Validity

External Validity

There were several threats to external validity in this study. The questionnaire was self-administered, and respondents may not have provided accurate, honest answers. Schools targeted for participation who declined might have threatened the validity of the study reflecting the general population. There is a possibility of social desirability bias where respondents who chose to participate may feel the need to provide socially acceptable responses. These concerns were minimized by reassuring respondents that no personal information such as respondents name, school, school district, city, or county will be identified in result reports. Schools and individual classrooms were randomly selected for participation. The sample size was weighted to ensure that responses adequately represented the state population.

Internal Validity

There was no threat to internal validity.

Construct Validity

The interpretation of the dependent variable, perception of harm, was not asked during the survey. This caused mono-method bias. Also known as common method variance, mono-method bias is a threat to construct validity when only a single method of measurement is used to measure the dependent variable (Donaldson & Grant-Vallone, 2002). This type of bias occurs when studies are based on self-reported responses

(Donaldson & Grant-Vallone, 2002). Instead of multiple methods of measuring perception of harm, students were asked how dangerous they considered the use of e-cigarettes. Students then self-reported their response as very dangerous, somewhat dangerous, not very dangerous, or not dangerous at all. Using a single method of measurement, primary researchers could not prove that the dependent variable was measured accurately. The questionnaire, which was modeled after the CDC's NYTS used in the original study, was considered reliable and valid because it accurately measured what it was intended repeatedly. Harm was defined as anything that damages the health of the body either physically or mentally or causes an adverse effect. I interpreted the response for this question as the definition for perception of harm perceived by the respondents.

Ethical Protection of Human Participants

All measures possible were taken to protect the individuals who elected to participate in this study. Each school selected for participation was required to complete a written consent form to participate. A parent or legal guardian of the selected classrooms participants was required to provide written consent following protocols approved by the University of Texas TPCC evaluation team and DSHS. DSHS' Institutional Review Board (IRB) was responsible for ensuring all research conducted by the state employees or representatives met ethical guidelines and United States federal regulations (DSHS, 2011). Completion of the study did not result in harm to any participants. All responses were de-identified to the state and public health region level after the collection process to limit ethical concerns. Participation was optional and participants could withdraw at

any time, even after parental consent was provided. Only individuals whose parents agreed to the informed consent could participate.

This study was a secondary analysis of a community partnered dataset collected by DSHS and Texas A&M University. Though the dataset was collected by DSHS, a state government agency, the dataset was not made publicly available. I was required to ask permission to use the dataset. Texas A&M University was asked to prepare the raw dataset for my use. I was required to email the PPRI at Texas A&M University to receive a copy of the data (Appendix A). I received prior approval to use these data by Walden's IRB division (approval number 10-25-18-0385259). Though there was no conflict of interest, it must be noted that the I am employed by DSHS but was not involved in this research study.

No identifiable data were contained within the dataset, and the secondary analysis study did not involve contact with individual students. All participant data remained anonymous. I received a temporary passcode to unlock the dataset, which was then saved on my personal computer that was password protected. No backup copy of the dataset was saved.

Summary

This chapter described the methodology, instrumentation, and research design of the study. I conducted a secondary analysis for a non-experimental, cross-sectional research design study. The purpose of the study was to determine the perception of harm of using e-cigarette and the relationship to exposure of state and/or school public health

antitobacco campaigns. Chapter 4 will provide a description on the study data collection process and a presentation of the results from the data analysis during the study.

Chapter 4: Results

Introduction

E-cigarette use is on the rise among Texas adolescents. However, efforts to include e-cigarettes in antitobacco campaigns have yet to be created. The purpose of this quantitative study was to determine the relationship between current use of e-cigarettes, exposure to state and public school antitobacco programs, and the perception of harm among Texas adolescents. I performed a secondary quantitative analysis study to address the research questions and hypotheses, using the 2016 Texas YTS dataset. The research questions and hypotheses are as followed:

RQ1: What is the relationship between e-cigarette use and perception of harm among Texas adolescents?

$H_0$1: There is no relationship between e-cigarette use and perception of harm among Texas adolescents.

H_a1: There is a relationship between e-cigarette use and perception of harm among Texas adolescents.

RQ 2: How does exposure to state antitobacco programs influence the perception of harm of e-cigarette use in Texas adolescents?

$H_0$2: Exposure to state antitobacco programs does not influence the perception of harm of e-cigarette use in Texas adolescents.

H_a2: Exposure to state antitobacco programs does influence the perception of harm of e-cigarette use in Texas adolescents.

RQ 3: How does exposure to school-based antitobacco activities influence the perception of harm of e-cigarettes in Texas adolescents?

$H_0$3: Exposure to school-based antitobacco programs does not influence the perception of harm of e-cigarette use in Texas adolescents.

H_a3: Exposure to school-based antitobacco programs does influence the perception of harm of e-cigarette use in Texas adolescents.

RQ4: How does the relationship between e-cigarette use and perception of harm differ based on area of residence (state vs. coalition resident) in Texas adolescents?

$H_0$4: There is no relationship between e-cigarette use and perception of harm based on area of residence (state vs. coalition resident) in Texas adolescents.

H_a4: There is a relationship between e-cigarette use and perception of harm based on area of residence (state vs. coalition resident) in Texas adolescents.

RQ5: How does the relationship between e-cigarette use and perception of harm differ based on socioeconomic status in Texas adolescents?

$H_0$5: There is no relationship between e-cigarette use and perception of harm based on socioeconomic status in Texas adolescents.

H_a5: There is a relationship between e-cigarette use and perception of harm based on socioeconomic status in Texas adolescents.

This chapter will discuss the data collection and statistical results.

Data Collection

For this study, I conducted a secondary analysis of the 2016 Texas YTS dataset. The IRB at Walden University granted permission for this study to be conducted

(approval number 10-25-18-0385259). I requested all available data for the 2016 Texas YTS from PPRI at Texas A&M University to answer my research questions. I received a de-identified dataset that was weighted by the primary investigator to ensure responses adequately represent the state population. Groups with less than 10 responses were also removed from the dataset by the primary researcher. The dataset contained all data for the independent variables (e-cigarette use and exposure to state/school antitobacco programs) and the dependent variable (perception of harm).

The 2016 Texas YTS included a state representative sample of middle school, junior high, and high school students and tobacco use. Demographic frequencies for the sampled population and the 2015-2016 public school enrollment rates are presented in Table 2. For the purpose of data display, ages 12 and 13, and ethnicity (Hispanic/not Hispanic) were combined to reflect enrollment records. For RQ 2 and RQ 3, the survey questions used to analyze the independent variables were combined. Question 2 was analyzed using five survey questions: (Survey Question 34a-e*: During the past 12 months, which of these antitobacco advertisements or events have you seen or taken part in (in reference to the following advertisements or events): an ad with a DUCK that said Tobacco is foul; an ad that asks if tobacco is Worth it; an ad about the effects of smokeless tobacco (Spit it Out); participated in a DUCK event where [they] learned different ways to say no to tobacco; an antitobacco advertisement or taken part in an antitobacco event not listed above).* All five survey questions were combined to make one independent variable for exposure to state antitobacco programs. Question 3 was analyzed using four survey questions: (Survey Question 32*: During the past 12 months,*

have you participated in any school-based antitobacco activities to discourage people your age from using cigarettes, chewing tobacco, snuff, or dip? Survey Question 33a-c: *During this school year in reference to: did you practice in any of your classes ways to say no to tobacco (for example, in role play); were you taught in any of your classes that most people your age do not use tobacco products; has what you learned in school helped you feel it is okay to say no to friends who offer you tobacco products).* All four survey questions were combined to make one independent variable for exposure to state antitobacco programs. Schools targeted for participation who declined might have threatened the external validity of the study. The sample size was weighted to ensure that responses adequately represented the state population. Additional demographic information for the study population can be found under demographic characteristics in Table 2. The sample that I received contained 10,717 cases containing participant demographics and survey responses.

Table 2

Demographic Characteristics of 2015-2016 Texas Student Enrollment

Characteristics	TX YTS 2016 Sample	Total 2015-2016 Texas Public School Enrollment[a]
Age		
12 to 13 years old	2,958	6,197
14 years old	1,408	313,366
15 years old	1,267	380,697
16 years old	1,258	368,599
17 years old	1,113	335,659
Gender		
Female	4,625	2,580,992
Male	4,540	2,718,736
Grade		
6th	1,325	390,522
7th	1,545	389,519
8th	1,725	386,562
9th	1,246	428,704
10th	1,229	386,534
11th	1,112	352,319
12th	1,057	323,487
Ethnicity		
Hispanic	2,976	1,353,503
Race		
American Indian or Alaska Native	335	20,917
Asian	114	213,394
Black or African American	702	668,338
Hispanic	2,976	2,767,747
Native Hawaiian or other Pacific Islander	64	7,406
White	5,475	1,513.027
More than one race	1,843	108,899
Economically Disadvantaged	2,109	3,122,903

[a] Statewide Totals (Texas Education Agency, 2016)

First, I sorted the data by the grade variable to identify any missing data. I used the Age-Based Grade Assignment (Table 1) to assign the missing grade variables. I then sorted the variables by each survey question necessary to answer the research questions. For each question, I excluded cases that had missing variables for the independent and dependent variables. In total, I excluded 1,478 cases. My final working dataset contained 9,239 cases.

To prepare for OLR analysis, I coded the variables for each question, as shown in Tables 3 and 4. Some demographic variables were re-coded for data analysis purposes and can be found under demographic characteristics.

Table 3

Demographic Characteristic Variable Values

Values	Labels
Age	
11 years old or younger	11
12 years old	12
13 years old	13
14 years old	14
15 years old	15
16 years old	16
17 years old	17
18 years old or older	18
Gender	
Female	0
Male	1
Grade	
6th	6
7th	7
8th	8
9th	9
10th	10
11th	11
12th	12
Ethnicity [a]	
Hispanic	0
Not Hispanic	1
Race	
American Indian or Alaska Native	1
Asian	2
Black or African American	3
Native Hawaiian or other Pacific Islander	4
More than one race	5
White	6
Socioeconomic Status [a]	
Yes, qualified for free/reduced lunch	0
No, not qualified for free/reduced lunch	1
Don't Know	2
Area of residence	
State Area Resident	0
Coalition Area Resident	1

[a] recoded for data analysis purposes

Table 4

Independent/Dependent Variable Values

Values	Labels
How dangerous do you think it is for a person your age to use electronic cigarettes, also called e-cigarettes, vape pens, e-hookah, hookah pens, and e-cigars, such as NJOY, Blu, or Logic? [a]	
Not dangerous at all	1
Not very dangerous	2
Somewhat dangerous	3
Very dangerous	4
Have you ever tried using electronic cigarettes, also called e-cigarettes, vape pens, e-hookah, hookah pens, and e-cigars, such as NJOY, Blu, or Logic? [b]	
No, never tried e-cigarettes	0
Yes, tried e-cigarettes	1
During the past 12 months, have you participated in any school-based antitobacco activities to discourage people your age from using cigarettes, chewing tobacco, snuff, or dip? [b]	
Yes	0
No	1
During this school year: Did you practice in any of your classes ways to say no to tobacco (for example, in role plays); Were you taught in any of your classes that most people your age do not use tobacco products; Has what you learned in school helped you feel it is okay to say no to friends who offer you tobacco products? [b]	
Yes	0
No	1
During the past 12 months, which of these antitobacco advertisements or events have you seen or taken part in: I saw or heard an ad with a DUCK that said, Tobacco is foul; I saw or heard an ad that asks if tobacco is Worth it; I saw an ad about the effects of smokeless tobacco (spit it out); I have participated in a DUCK event where I learned different ways to say no to tobacco; I have seen an antitobacco advertisement or taken part in an antitobacco event not listed above. [b]	
Yes	0
No	1

[a] Dependent variable
[b] Independent variables

Chi-Square and Ordinal Logistic Regression

A Chi-Square and OLR Regression analysis (Table 5) was conducted to determine the relationship between the categorical variables. Findings revealed a significant correlation between the dependent variable and the covariates and independent variables. Some results did not have a statistically significant correlation to the dependent variables in the analysis. The results from the chi-square analysis are shown in Table 5.

Table 5

Results of the Relationship between Perception of Harm and Categorical Variables

Variable	*Estimate*	*p-value*
Demographics		
Gender†	115.607	.000
Grade‡		
6th	3.396	.000
7th	2.388	.000
8th	1.666	.000
9th	1.213	.015
10th	1.092	.267
11th	1.025	.761
12th	Reference	
Ethnicity‡		
Yes, Mexican, Mexican American or Chicano	.986	.815
Yes, Some other Hispanic not listed	1.020	.826
No, not Hispanic	Reference	
Ethnicity Recoded †		
Hispanic	10.696	.013
Not Hispanic	Reference	
Race‡		
American Indian or Alaska Native	1.039	.734
Asian	1.429	.059
Black or African American	1.115	.160
Native Hawaiian or other Pacific Islander	1.005	.985
More than one race	.893	.055
White	Reference	
Socio-economic Status† (To assess SES, students were asked, *During the current school year, do you qualify for free or reduced-price school lunch?)*	24.355	.000
Coalition Status (Nine publicly funded areas across Texas that were designed to provide evidenced-based, community-planned environment tobacco prevention and control activities in targeted areas)	12.207	.007

(table continues)

Variable	*Estimate*	*p-value*
Independent Variable		
Tried Electronic Cigarettes†	456.564	.000
Participated in Anti-Smoking State Activity Overall†	37.672	.000
#34a: Seen DUCK Advertisement	32.724	.000
#34b: Seen Worth-It Advertisement	60.463	.000
#34c: Seen Spit It Out Campaign	4.218	.239
#34d: Participated in DUCK Event	43.389	.000
#34e: Seen/Participated in other Ad/Campaign	36.360	.000
Participated in Anti-Smoking School Activity Overall†	19.581	.000
#32 Participate in Anti-Smoking School Activity	89.167	.000
#33a: Practiced Say No	167.931	.000
#33b: Taught Smoking Facts	106.883	.000
#33c: Has Anti-Smoking Been Helpful	325.809	.000

Note. Perception of harm was based on how dangerous students considered the use of electronic cigarettes.

Linear Regression

Linear regression was used to analyze the relationship between the covariate age and the dependent variable perception of harm. The results from the linear regression analysis are shown in Table 6.

Table 6

Model Summary of Age and Perception of Harm

Model	R	R Squared	Adjusted R Square	Standard Error of the Estimates	Durbin-Watson
Age	.190	.036	.036	.97607	.046

ANOVA

Model	Sum of Squares	*df*	Mean Square	F	Sig
Regression	329.461	1	329.461	345.817	.000
Residual	8793.451	9230	.953		
Total	9122.912	9231			

Coefficients[a]

Note. df= degrees of freedom

(table continues)

Model		Standardized Coefficients				95% CI for β	
	β	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
(Constant)	4.509	.074		61.061	.000	4.365	4.654
Age	-.094	.005	-.190	-18.596	.000	-.104	-.084

[a] Dependent variable: Perception of harm
Note. CI = confidence interval; β= Beta

For every unit increase for age, there is an expected -0.094 unit decrease in perception of harm. The results were statistically significant ($p<0.05$).

Demographic Characteristics

The demographic characteristics of the sample are reported in this section. The demographic characteristics consist of age, gender, grade level, ethnicity, race, socioeconomic status, and area of residence. The demographics are presented in frequency tables 7-16.

Table 7 presents the frequency table for age of the participants. Ages above 18 were not specified but rather listed as 18 years old or older. Age below 11 was categorized as 11 years old or younger. There were 7 (0.1%) no responses.

Table 7

Frequency Table of Age

Age	*N*	%
11 years old or younger	509	5.5
12 years old	1272	13.8
13 years old	1686	18.2
14 years old	1408	15.2
15 years old	1267	13.7
16 years old	1258	13.6
17	1113	12.0
18	719	7.8
Missing	7	0.1
Total	9239	100.0

Table 8 presents the frequency table for the gender of the participants; 50.1% (*N*=4,625) were female and 49.1% (*N*=4,540) were male. There were 74 (0.8%) no responses.

Table 8

Frequency Table of Gender

Gender	*N*	%
Female	4625	50.1
Male	4540	49.1
Missing	74	.8
Total	9239	100.0

Table 9 present the frequency table for grade of the participants. The sample included grades sixth through 12th with the largest number of participants in the eighth grade (*N*=1725, 18.7%). Fourteen percent (*N*=1325) of the students were in 6th grade, 16.7% (*N*=1545) in seventh, 13.5% (*N*=1246) in 9th, 13.3% in 10th (*N*=1229), 12% in 11th (*N*=1112), and 11.4% (*N*=1057) in 12th grade. There were zero no responses.

Table 9

Frequency Table of Grade

Grade	*N*	%
6th	1325	14.3
7th	1545	16.7
8th	1725	18.7
9th	1246	13.5
10th	1229	13.3
11th	1112	12.0
12th	1057	11.4
Total	9239	100.0

Tables 10 and 11 presents the frequency table for ethnicity of the participants. Ethnicity was categorized into: not Hispanic or Latino, Mexican, Mexican American, or Chicano, and other Hispanic or Latino not listed. Sixty six percent (*N*=6146) considered themselves not Hispanic or Latino, while 25.2% (*N*=2329) considered themselves Mexican, Mexican American or Chicano, and 7% (*N*=647) identifying as other Hispanic or Latino not listed. There were 117 (1.33%) no responses. Ethnicity was recoded into yes, I am Hispanic (n=2,976) and no, I am not Hispanic (n=6,146).

Table 10

Frequency Table of Ethnicity

Ethnicity	*N*	%
Not Hispanic or Latino	6146	66.5
Yes, I am Mexican, Mexican American or Chicano	2329	25.2
Yes, I am some other Hispanic or Latino not listed here	647	7.0
Missing	117	1.3
Total	9122	98.7

Table 11

Frequency Table of Ethnicity Recoded

Ethnicity Recoded	*N*	%
Yes, I am Hispanic	2976	32.2
No, I am not Hispanic	6146	66.5
Missing	117	1.3
Total	9239	100.0

Table 12 presents the frequency table for race of the participants. Race was categorized into American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, White, and more than one race. Majority of participants consider themselves White with 59.3% (*N*=5475). The remaining sample included 3.6% American Indian or Alaska Native (*N*=335), 1.2% Asian (*N*=114), 7.6% Black or African American (*N*=702), 0.7% Native Hawaiian or other Pacific Islander (*N*=64), or nearly 20% more than one race (*N*=1843). There were 706 (7.6%) no responses.

Table 12

Frequency Table of Race

Race	*N*	%
American Indian or Alaska Native	335	3.6
Asian	114	1.2
Black or African American	702	7.6
Native Hawaiian or other Pacific Islander	64	.7
White	5475	59.3
More than one race	1843	19.9
Missing	706	7.6
Total	9329	100.0

Table 13 presents the frequency table for socioeconomic status of the participants as presented by qualifying for free or reduced school lunch. Majority of respondents did not know 39.1% (*N*=3616) if they qualified for free or reduced lunch while nearly 23% selected yes (*N*=2109), and 37.4% selected no (*N*=3451).

Table 13

Frequency Table of Socioeconomic Status

Qualified for free or reduced lunch	*N*	%
Yes	2109	22.8
No	3451	37.4
Don't know	3616	39.1
Total	9176	99.3
Missing	63	.7
Total	9239	1000

Note. Socioeconomic status was based on if student qualified for reduced price or free lunch.

Table 14 presents the frequency table for area of residence for the participants as presented. Area of residence was categorized by coalition resident and state resident. Majority of respondents 55.4% (*N*=5114) were considered a state area resident while 44.6% (*N*=4125) were considered a coalition area resident.

Table 14

Frequency Table of Area of Residence

	N	%
State Area Resident	5114	55.4
Coalition Area Resident	4125	44.6
Total	9239	100.0

Table 15 presents the frequency table for perception of harm of using e-cigarettes. Nearly 50% (*N*=4592) of respondents considered e-cigarettes very dangerous while 23.7% (*N*=2191) considered e-cigarettes somewhat dangerous, 18.3% (*N*=1692) considered them not very dangerous, and 8.3% (*N*=764) considered them not dangerous

at all.

Table 15

Frequency Table of Perception of Harm of Electronic Cigarettes

Perception of harm	*N*	%
Very dangerous	4592	49.7
Somewhat dangerous	2191	23.7
Not very dangerous	1692	18.3
Not dangerous at all	764	8.3
Total	9239	100.0

Note. Perception of harm was based on how dangerous students considered the use of electronic cigarettes.

Results

This section includes the descriptive statistics of the study variables, statistical assumptions, and statistical test analysis and results. The complete sample size included 10,717 participants. There were 1,478 cases with missing data that were excluded leaving a final sample size of 9,239 participants.

Descriptive Statistics

The descriptive statistics of the independent and dependent variables will be presented in this section. The independent variables will be e-cigarette use, exposure to state antitobacco programs, and exposure to school-based antitobacco activities. The dependent variable will be perception of harm. Gender, grade level, school level, age, and race, ethnicity, socioeconomic status (SES), and area of residence will be included as covariates.

Research question 1. The first research question examined the relationship between the use of e-cigarettes and the perception of harm among Texas adolescents. The independent variable for this test was the use of e-cigarettes, and the dependent variable was perception of harm among Texas adolescents. For this study, the independent variable use of e-cigarettes was recoded from a 3-level nominal variable (no never heard of, yes, and no) to a dichotomous variable with response options of no, never tried e-cigarettes or yes. Of the students who have never tried e-cigarettes, 20.2% (*N*=1868) have never heard of e-cigarettes. The frequency is shown in Table 16. Because the independent variable was nominal and the dependent variable was ordinal, OLR test was appropriate.

Table 16

Frequency Table of Tried Electronic Cigarettes

	N	%
No, never tried e-cigarettes	3953	42.8
Yes	5286	57.2
Total	9239	100.0

An OLR was performed to test for potential confounding and interactions between the use of e-cigarettes and the perception of harm, and covariates among Texas adolescents. Table 17 displays the results for model 1 (main effect), model 2 (test for confounders), and model 3 (test for interactions) for question 1. African American tested significantly as a confounding variable. Gender (female), grade levels sixth through eighth, and Asian tested significantly as confounding and as interaction variables. Overall, Texas adolescents who have tried e-cigarettes were 0.512 times less likely (β=-

0.670) to rate perception of harm as less dangerous (Expβ=0.512, 95% CI [0.474, 0.533], Wald X^2 (1) =286.866, p=0.00).

Table 17

Relationship Between Electronic Cigarette Use and Perception of Harm using Ordinal Logistic Regression (OLR)

Variable	Model 1 Main Effect Model	Model 2 Estimate	Wald (x^2)	Sig.	Exp β	95% Confidence Interval Lower	Upper
E-cigarette Use (Crude, Model 1)	-0.670		286.866	0.00	0.512	0.474	0.553
E-cigarette Use (Adjusted Model 2)		-0.700	270.653	0.00	0.497	0.457	0.540
Age		0.023	0.490	0.48	1.023	0.960	1.090
Gender (female)		0.364	75.748	0.00	1.440	1.326	1.563
Grade							
6th		1.354	42.040	0.00	3.875	2.573	5.835
7th		0.881	24.649	0.00	2.412	1.704	3.415
8th		0.503	11.426	0.00	1.654	1.235	2.215
9th		0.163	1.788	0.18	1.178	0.927	1.496
10th		0.083	0.688	0.41	1.087	0.893	1.324
11th		0.017	0.038	0.85	1.017	0.857	1.207
12th		Reference					
Ethnicity							
Yes, I am Hispanic		0.051	0.867	0.35	1.052	0.945	1.171
No, I am not Hispanic		Reference					
Race							
American Indian or Alaska Native		0.041	0.133	0.71	1.042	0.836	1.298
Asian		0.445	5.421	0.02	1.561	1.073	2.270
Black or African American		0.149	3.596	0.05	1.161	0.995	1.354

(table continues)

Variable	Model 1 Main Effect Model	Model 2 Estimate	Wald (x^2)	Sig.	Exp β	95% Confidence Interval Lower	Upper
Native Hawaiian or other Pacific Islander		0.141	0.319	0.57	1.151	0.706	1.875
White		Reference					

Model 3 - Interaction Model

Variable	Estimate	Wald (x^2)	Sig.	Exp β	95 % Confidence Interval Lower	Upper
E-cigarette Use	1.107	0.911	0.34	3.025	0.312	29.367
Age	0.081	3.089	0.79	1.085	0.991	1.188
Age* E-cigarette	-0.130	3.948	0.47	0.878	0.772	0.998
Gender	0.292	27.256	0.00	1.341	1.201	1.497
Female* E-cigarette	0.140	2.766	0.09	1.151	0.975	1.358
Grade						
6^{th}	1.104	13.705	0.00	3.017	1.682	5.414
6^{th} * E-cigarette	0.488	1.357	0.24	1.629	0.717	3.702
7^{th}	0.844	11.035	0.00	2.326	1.413	3.826
7^{th} * E-cigarette	0.090	0.064	0.80	1.094	0.544	2.199
8^{th}	0.587	7.535	0.00	1.799	1.183	2.736
8^{th} * E-cigarette	-0.240	0.642	0.42	0.787	0.438	1.415
9^{th}	0.195	1.244	0.26	1.215	0.863	1.711
9^{th} * E-cigarette	-0.128	0.271	0.60	0.880	0.543	1.425
10^{th}	0.099	0.473	0.49	1.104	0.833	1.461
10^{th} * E-cigarette	-0.096	0.244	0.63	0.909	0.611	1.352
11^{th}	0.015	0.015	0.90	1.106	0.792	1.303

(table continues)

Variable	Estimate	Wald (x^2)	Sig.	Exp β	95 % Confidence Interval Lower	Upper
11th * E-cigarette	-0.101	0.003	0.95	0.990	0.701	1.398
12th	Reference					
12th * E-cigarette	Reference					
Ethnicity						
Yes, I am Hispanic	-0.040	0.276	0.59	0.960	0.826	1.117
Yes, I am Hispanic * E-cigarette	0.152	1.928	0.16	1.165	0.939	1.444
No, I am not Hispanic	Reference					
No, I am not Hispanic * E-cigarette	Reference					
Race						
American Indian or Alaska Native	-0.108	0.503	0.47	0.897	0.655	1.210
American Indian or Alaska Native * E-cigarette	0.343	2.315	0.12	1.409	0.906	2.190
Asian	0.659	5.552	0.01	1.932	1.117	3.342
Asian * E-cigarette	-0.422	1.181	0.27	0.656	0.306	1.404
Black or African American	0.168	2.416	0.12	1.183	0.957	1.461
Black or African American * E-cigarette	-0.113	0.513	0.47	0.893	0.654	1.218
Native Hawaiian or other Pacific Islander	0.017	0.002	0.96	1.017	0.509	2.032
Native Hawaiian or other Pacific Islander * E-cigarette	0.245	0.242	0.62	1.278	0.481	3.394
More than one race	-0.69	0.719	0.39	0.933	0.795	1.095
More than one race * E-cigarette	-0.020	0.027	0.86	0.981	0.776	1.238
White	Reference					
White * E-cigarette	Reference					

Notes. β= beta; *df*= degree of freedom; Exp β= odds ratio

Research question 2. The second research question examined the relationship between the exposure to state antitobacco programs and the perception of harm among Texas adolescents. The independent variable for this test was the exposure to state antitobacco programs and the dependent variable was perception of harm among Texas adolescents. Because the independent variable was nominal and the dependent variable was ordinal, OLR test was appropriate. Question 2 was analyzed using 5 survey questions (Survey Question 34a-e*: During the past 12 months, which of these antitobacco advertisements or events have you seen or taken part in (in reference to the following advertisements or events): an ad with a DUCK that said Tobacco is foul; an ad that asks if tobacco is Worth it; an ad about the effects of smokeless tobacco (Spit it Out); participated in a DUCK event where [they] learned different ways to say no to tobacco; an antitobacco advertisement or taken part in an antitobacco event not listed above).* All 5 survey questions were combined to make one independent variable for exposure to state antitobacco programs (Table 18**).**

Table 18

*Frequency of Survey Questions 34a-e Combined**

	N	%
Yes, I have participated in at least 1 state antitobacco program this school year	7131	77.2
No, I have not participated in a state antitobacco program this school year	2108	22.8
Total	9239	100.0

Note: Survey Question 34a-e: During the past 12 months, which of these antitobacco advertisements or events have you seen or taken part in (in reference to the following advertisements or events): an ad with a DUCK that said Tobacco is foul; an ad that asks if tobacco is Worth it; an ad about the effects of smokeless tobacco (Spit it Out); participated in a DUCK event where [they] learned different ways to say no to tobacco; an antitobacco advertisement or taken part in an antitobacco event not listed above

An OLR was performed to test for potential confounding and interactions between the participation in a state antitobacco program and the perception of harm, and covariates among Texas adolescents. Table 19 displays the results for model 1 (main effect), model 2 (test for confounders), and model 3 (test for interactions) for question 2. Gender (female), grade levels sixth through eighth, and Asian tested significantly as confounders. Gender (female), sixth grade, and more than one race tested significantly as interactions. Overall, Texas adolescents who participated in any state antitobacco program were 1.235 times more likely (β=0.211) to rate perception of harm as more dangerous (Expβ=1.235, 95% CI [1.129, 1.352], Wald X^2 (1) =21.102, p=0.00).

Table 19

Relationship Between Participation in a State Antitobacco Program and Perception of Harm using OLR

Variable	Model 1 Main Effect Model	Model 2 Estimate	Wald (x^2)	Sig.	Exp β	95% Confidence Interval Lower	Upper
Participation in a State Antitobacco Program (Crude, Model 1)	0.211		21.102	0.00	1.235	1.129	1.352
Participation in a State Antitobacco Program (Adjusted Model 2)		0.275	31.725	0.00	1.317	1.197	1.449
Age		-0.014	0.176	0.67	0.986	0.926	1.051
Gender (female)		0.377	81.526	0.00	1.457	1.342	1.582
Grade							
6th		1.164	31.246	0.00	3.203	2.130	4.818
7th		0.786	19.711	0.00	2.196	1.552	3.107
8th		0.469	9.958	0.00	1.599	1.195	2.140
9th		0.143	1.397	0.23	1.155	0.909	1.467
10th		0.073	0.528	0.46	1.075	0.884	1.309
11th		-0.015	0.028	0.86	0.986	0.831	1.169
12th		Reference					
Ethnicity							
Yes, I am Hispanic		-0.021	0.143	0.70	0.980	0.880	1.090
No, I am not Hispanic		Reference					
Race							
American Indian or Alaska Native		0.033	0.088	0.76	1.034	0.830	1.287
Asian		0.390	4.215	0.04	1.477	1.018	2.142
Black or African American		0.114	2.123	0.14	1.121	0.961	1.307

(table continues)

Variable	Model 1 Main Effect Model	Model 2 Estimate	Wald (x^2)	Sig.	Exp β	95% Confidence Interval Lower	Upper
Native Hawaiian or other Pacific Islander		0.081	0.108	0.74	1.085	0.668	1.763
More than one race		-0.094	2.550	0.11	0.910	0.811	1.022
White		Reference					

Model 3 - Interaction Model

Variable	Estimate	Wald (x^2)	Sig.	Exp β	95% Confidence Interval Lower	Upper
Participation in State Antitobacco Program	-0.827	0.320	0.57	0.437	0.025	7.674
Age	-0.068	0.846	0.35	0.934	0.807	1.081
Age * Participation in State Antitobacco Program	0.067	0.659	0.417	1.069	0.909	1.258
Gender	0.363	17.921	0.00	1.438	1.214	1.702
Gender * Participation in State Antitobacco Program	0.020	0.042	0.83	1.020	0.842	1.237
Grade						
6th	0.933	3.962	0.04	2.542	1.014	6.371
6th * Participation in State Antitobacco Program	0.282	0.290	0.59	1.326	0.475	3.699
7th	0.711	3.189	0.07	0.036	0.933	4.444
7th * Participation in State Antitobacco Program	0.079	0.031	0.85	1.082	0.452	2.587
8th	0.535	2.626	0.10	1.708	0.894	3.264
8th * Participation in State Antitobacco Program	-0.105	0.080	0.77	0.900	0.436	1.860
9th	0.065	0.059	0.80	1.068	0.630	1.810
9th * Participation in State Antitobacco Program	0.091	0.091	0.76	1.095	0.606	1.980
10th	-0.009	0.002	0.96	0.991	0.654	1.502
10th * Participation in State Antitobacco Program	0.105	0.189	0.66	1.111	0.693	1.781
11th	-0.065	0.122	0.72	0.9.7	0.649	1.352
11th * Participation in State Antitobacco Program	0.063	0.089	0.76	1.065	0.703	1.612

(table continues)

Variable		Estimate	Wald (x^2)	Sig.	Exp β	95% Confidence Interval Lower	Upper
	12th	Reference					
	12th * Participation in State Antitobacco Program	Reference					
Ethnicity							
	Yes, I am Hispanic	-0.026	0.049	0.82	0.974	0.775	1.225
	Yes, I am Hispanic * Participation in State Antitobacco Program	0.011	0.007	0.93	1.011	0.780	1.310
	No, I am not Hispanic	Reference					
	No, I am not Hispanic * Participation in State Antitobacco Program	Reference					
Race							
	American Indian or Alaska Native	-0.043	0.033	0.85	0.958	0.601	1.525
	American Indian or Alaska Native * Participation in State Antitobacco Program	0.098	0.131	0.71	1.102	0.650	1.869
	Asian	0.654	2.999	0.08	1.923	0.917	4.031
	Asian * Participation in State Antitobacco Program	-0.351	0.644	0.42	0.704	0.299	1.658
	Black or African American	0.178	1.001	0.31	1.195	0.843	1.693
	Black or African American * Participation in State Antitobacco Program	-0.076	0.147	0.70	0.927	0.629	1.366
	Native Hawaiian or other Pacific Islander	-0.242	0.146	0.70	0.785	0.227	2.714
	Native Hawaiian or other Pacific Islander * Participation in State Antitobacco Program	0.375	0.298	0.58	1.456	0.378	5.604
	More than one race	-0.301	5.809	0.01	0.740	0.579	0.945
	More than one race * Participation in State Antitobacco Program	0.266	3.514	0.06	1.305	0.988	1.723
	White	Reference					
	White * Participation in State Antitobacco Program	Reference					

Notes. β= beta; *df*= degree of freedom; Exp β= odds ratio

Research question 3. The third research question examined the relationship between exposure to school-based antitobacco activities and the perception of harm among Texas adolescents. The independent variable for this test was exposure to school-based antitobacco activities and the dependent variable was perception of harm among Texas adolescents. Because the independent variables were nominal and the dependent variable was ordinal, OLR test was appropriate. Question 3 was analyzed using 4 survey questions: (Survey Question 32*: During the past 12 months, have you participated in any school-based antitobacco activities to discourage people your age from using cigarettes, chewing tobacco, snuff, or dip*? Survey Question 33a-c: *During this school year in reference to: did you practice in any of your classes ways to say no to tobacco (for example, in role play); were you taught in any of your classes that most people your age do not use tobacco products; has what you learned in school helped you feel it is okay to say no to friends who offer you tobacco products).* All 4 survey questions were combined to make one independent variable for exposure to state antitobacco programs (Table 20).

Table 20

*Frequency of Survey Questions 32, 33a-c Combined**

	N	%
Yes, I have participated in at least one school antitobacco program this school year	6855	74.2
No, I have not participated in a school antitobacco program this school year	2384	25.8
Total	9239	100.0

Note. Survey Question 32: During the past 12 months, have you participated in any school-based antitobacco activities to discourage people your age from using cigarettes, chewing tobacco, snuff, or dip? Survey Question 33a-c: During this school year in reference to: did you practice in any of your classes ways to say no to tobacco (for example, in role play); were you taught in any of your classes that most people your age do not use tobacco products; has what you learned in school helped you feel it is okay to say no to friends who offer you tobacco products.

An OLR was performed to test for potential confounding and interactions between the participation in a school-based antitobacco program and the perception of harm, and covariates among Texas adolescents. Table 21 displays the results for model 1 (main effect), model 2 (test for confounders), and model 3 (test for interactions) for question 3. Gender (female), grade levels sixth through eighth, and Asian tested significantly as confounders. Gender (female) and sixth and seventh grades, and Native Hawaiian or other Pacific Islander * school antitobacco activity participation tested significantly as interactions. Overall, Texas adolescents who participated in any school-based antitobacco program were 1.151 times more likely (β=0.140) to rate perception of harm as more dangerous (Expβ=1.151, 95% CI [1.055, 1.255], Wald X^2 (1) =10.057, p=0.00).

Table 21

Relationship Between Participation in a School Antitobacco Program and Perception of Harm using OLR

Variable	Model 1 Main Effect Model	Model 2 Estimate	Wald (x^2)	Sig.	Exp β	95% Confidence Interval Lower	Upper
Participation in a School-Based Antitobacco Program (Crude, Model 1)	0.140		10.057	0.00	1.151	1.055	1.255
Participation in a School-Based Antitobacco Program (Adjusted Model 2)		0.069	2.145	0.143	1.071	0.977	1.175
Age		-0.008	0.064	0.80	0.992	0.931	1.057
Gender (female)		0.369	78.416	0.00	1.446	1.333	1.569
Grade							
6th		1.180	32.182	0.00	3.255	2.135	4.894
7th		0.806	20.736	0.00	2.238	1.582	3.166
8th		0.476	10.247	0.00	1.609	1.202	2.153
9th		0.159	1.707	0.19	1.173	0.923	1.489
10th		0.074	0.552	0.45	1.077	0.885	1.311
11th		-0.007	0.006	0.93	0.993	0.837	1.178
12th		Reference					
Ethnicity							
Yes, I am Hispanic		-0.017	0.103	0.74	0.983	0.883	1.093
No, I am not Hispanic		Reference					
Race							
American Indian or Alaska Native		0.045	0.165	0.68	1.046	0.840	1.303
Asian		0.378	3.973	0.04	1.460	1.006	2.117
Black or African American		0.126	2.610	0.10	1.135	0.973	1.323

(table continues)

Variable	Model 1 Main Effect Model	Model 2 Estimate	Wald (x^2)	Sig.	Exp β	95% Confidence Interval Lower	Upper
Native Hawaiian or other Pacific Islander		0.103	0.173	0.67	1.109	0.682	1.801
More than one race		-0.088	2.212	0.13	0.916	0.816	1.028
White		Reference					

Model 3 - Interaction Model

Variable	Estimate	Wald (x^2)	Sig.	Exp β	95% Confidence Interval Lower	Upper
Participation in a School-Based Antitobacco Program	0.291	0.048	0.82	1.338	0.098	18.207
Age	0.009	0.017	0.89	1.009	0.888	1.146
Age * Participation in a School-Based Antitobacco Program	-0.022	0.087	0.76	0.978	0.844	1.134
Gender	0.272	11.371	0.00	1.312	1.121	1.537
Gender * Participation in a School-Based Antitobacco Program	0.133	2.000	0.15	1.142	0950	1.374
Grade						
6th	1.189	7.996	0.01	3.283	1.440	7.484
6th * Participation in a School-Based Antitobacco Program	-0.001	0.000	0.10	0.999	0.387	2.582
7th	0.706	3.934	0.05	2.025	1.008	4.067
7th * Participation in a School-Based Antitobacco	0.140	0.116	0.73	1.150	0.515	2.571
8th	0.407	1.876	0.17	1.502	0.839	2.686
8th * Participation in a School-Based Antitobacco	0.104	0.091	0.76	1.109	0.566	2.173
9th	0.245	1.030	0.31	1.278	0.796	2.053
9th * Participation in a School-Based Antitobacco	-0.104	0.139	0.71	0.901	0.520	1.560
10th	0.084	0.196	0.66	1.088	0.749	1.581

(table continues)

Variable		Estimate	Wald (x^2)	Sig.	Exp β	95% Confidence Interval Lower	Upper
	10th * Participation in a School-Based Antitobacco	-0.007	0.001	0.98	0.993	0.640	1.542
	11th	-0.008	0.002	0.96	0.993	0.720	1.368
	12th * Participation in a School-Based Antitobacco	Reference					
Ethnicity							
	Yes, I am Hispanic	0.100	0.809	0.36	1.105	0.889	1.373
	Yes, I am Hispanic * Participation in a School-Based Antitobacco Program	-0.154	1.465	0.22	0.857	0.668	1.100
	No, I am not Hispanic	Reference					
	No, I am not Hispanic * Participation in a School-Based Antitobacco Program	Reference					
Race							
	American Indian or Alaska Native	-0.162	0.629	0.43	0.850	0.570	1.269
	American Indian or Alaska Native * Participation in a School-Based Antitobacco Program	0.292	1.429	0.23	1.340	0.829	2.164
	Asian	0.632	1.612	0.20	1.882	0.709	4.995
	Asian * Participation in a School-Based Antitobacco Program	-0.296	0.303	0.58	0.743	0.259	2.137
	Black or African American	-0.006	0.001	0.97	0.994	0.734	1.347
	Black or African American * Participation in a School-Based Antitobacco Program	0.181	1.017	0.31	1.198	0.843	1.704
	Native Hawaiian or other Pacific Islander	-0.864	2.677	0.10	0.422	0.150	1.186
	Native Hawaiian or other Pacific Islander * Participation in a School-Based Antitobacco Program	1.231	4.205	0.04	3.426	1.056	11.099
	More than one race	-0.168	1.982	0.16	0.845	0.668	1.068
	More than one race * Participation in a School-Based Antitobacco Program	0.108	0.619	0.43	1.114	0.851	1.459
	White	Reference					
	White * Participation in a School-Based Antitobacco Program	Reference					

Notes. β= beta; *df*= degree of freedom; Exp β= odds ratio

Research question 4. The fourth research question examined the relationship between the use of e-cigarettes and the perception of harm among Texas adolescents as it relates to area of residence. The independent variable for this test was the use of e-cigarettes and the dependent variable was perception of harm among Texas adolescents. Area of residence was used as a covariate. Because the independent variable and covariate was nominal and the dependent variable was ordinal, OLR test was appropriate. All results were statistically significant and there was no variation in perception of harm regardless of where the student resides. Students who have tried e-cigarettes were 0.752 times less likely to rate perception of harm less dangerous (β=-0.285) if they live in a state resident area compared to a coalition area (Expβ = 0.752, 95% CI [0.644, 0.878], Wald $\chi^2(1) = 13.024$, $p<0.000$) (Table 22).

Table 22

Relationship Between Electronic Cigarette Use and Perception of Harm by Area of Residence using OLR

Variable	β	Wald (x^2)	Sig.	Exp β	95% Confidence Interval Lower	Upper
Perception of harm of electronic cigarette use by area of residence	-0.285	13.024	0.000	0.752	0.644	0.878

Notes. β= beta*; df*= degree of freedom; Exp β= odds ratio

Research question 5. The fifth research question examined the relationship between the use of e-cigarettes and the perception of harm among Texas adolescents as it relates to socioeconomic status. The independent variable for this test was the use of e-cigarettes and the dependent variable was perception of harm among Texas adolescents with socioeconomic status being a covariate. Because the independent variable and the covariate was nominal and the dependent variable was ordinal, OLR test was appropriate.

Students who have never tried e-cigarettes were 0.752 times less likely to rate perception of harm less dangerous (β=-0.285) if they had a higher socioeconomic status (Expβ = 0.752, 95% CI [0.630, 0.897], Wald $\chi^2(1) = 10.060$, $p=0.002$) (Table 23).

Table 23

Relationship Between Electronic Cigarette Use and Perception of Harm by Socioeconomic Status using OLR

Variable	β	Wald (x^2)	Sig.	Exp β	95% Confidence Interval Lower	Upper
Perception of harm of electronic cigarette use by higher socioeconomic status	-0.285	10.060	0.002	0.752	0.630	0.897

Notes. β= beta*; df*= degree of freedom; Exp β= odds ratio

Summary

This quantitative cross-sectional study was conducted to determine the relationship between the use of e-cigarettes and the perception of harm among Texas adolescents. The first null hypothesis was tested using OLR and was rejected. There is a relationship between e-cigarette use and perception of harm. The second null hypothesis was tested using OLR and was rejected. Exposure to state antitobacco programs does influence the perception of harm of e-cigarette use in Texas adolescents. The third null hypothesis was tested using OLR and was rejected. Exposure to school-based antitobacco programs does influence the perception of harm of e-cigarette use in Texas adolescents. The fourth null hypothesis was tested using OLR and was rejected. There is a relationship between e-cigarette use and perception of harm based on area of residence (state vs. coalition resident) in Texas adolescents. The fifth null hypothesis was tested using OLR

and was rejected. There is a relationship between e-cigarette use and perception of harm based on socioeconomic status in Texas adolescents. In Chapter 5, I will interpret the findings, discuss study limitations, suggestions for social change, and recommendations for future research study.

Chapter 5: Discussion

Introduction

In this dissertation, I determined the relationship between current use of e-cigarettes, exposure to state and public school antitobacco programs, and the perception of harm among Texas adolescents. Data was analyzed using the 2016 Texas YTS for Texas middle and high school students enrolled in Texas public schools. Five research questions were answered by using Pearson's chi-square test, linear regression, and OLR. Reasons for e-cigarette use and perception of harm were analyzed by both SES and coalition status. Further discussion of this chapter relates to interpretation of findings, study limitations, recommendations for future research, and implications for social change.

Interpretation of Findings

The findings generated from this study may allow public health professionals and the public to have a better understanding of adolescent perceptions toward e-cigarette use. The purpose of this study was to determine the perception of harm of using e-cigarette and the relationship to exposure of state and/or school public health antitobacco campaigns.

Prevalence of Adolescent Use

E-cigarette use is on the rise in the youth-aged population of the United States (Carroll-Chapman & Wu, 2014). The use of e-cigarettes by youth in middle and high school more than doubled between 2011 and 2012 (Ramo et al., 2015). Results generated in my study showed that 57% of Texas students have tried e-cigarettes. This aligns with national results that adolescent e-cigarette use is on the rise.

Perception of Harm

Perception is the foundation for attitudes and helps determine an individual's health beliefs and can influence decision making (Gibson et al., 2018). E-cigarettes are marketed as a safer alternative to conventional cigarettes, which could possibly change user perception of the device. Among individuals aware of e-cigarettes, 52.9% reported they were less harmful and 26.4% less addictive than tobacco (Gibson et al., 2018). Those perceiving e-cigarettes as less harmful or addictive than traditional cigarettes had the highest prevalence of use (Carroll-Chapman & Wu, 2014). Majority of participants in my study considered e-cigarettes as very dangerous (49.7%) while only 8.3% considered the device not dangerous at all. Of the adolescents who considered e-cigarettes very dangerous, 63% admitted to e-cigarette use. This is opposite of results reported in previous studies. The results from my study imply that even though e-cigarettes are perceived as very dangerous, adolescents still use the product.

Impact of Prevention Programs

The purpose of the DSHS Tobacco Prevention and Control unit is to reduce the health and economic effects associated with tobacco use in citizens of Texas (DSHS, 2018). One of the responsibilities of DSHS is to create media campaigns to educate Texans about the dangers associated with tobacco use throughout the state (DSHS, 2018). A pilot study was conducted in the coalition areas to evaluate the effectiveness of current tobacco prevention initiatives, and the results showed a 40% decline in use among sixth and seventh grades with an increase in tobacco cessation in youth and young adults (DSHS, 2017). The results generated from my study concluded that adolescents exposed to state and school public health antitobacco campaigns are likely to perceive use of e-

cigarettes as harmful. However, results also show that adolescents perceive use of e-cigarettes regardless of SES or area of residence as less harmful. The results conclude that antitobacco campaigns may not be effectively discouraging use of e-cigarettes even though they are perceived as harmful.

Research Questions

The results of the OLR showed the following results for the research questions and hypotheses:

RQ1: What is the relationship between e-cigarette use and perception of harm among Texas adolescents?

$H_0$1: There is no relationship between e-cigarette use and perception of harm among Texas adolescents.

H_a1: There is a relationship between e-cigarette use and perception of harm among Texas adolescents.

Research Question 1 was intended to determine the relationship between e-cigarette use and perception of harm among demographic characteristics. The results of the OLR did conclude there is a relationship between e-cigarette use and perception of harm among Texas adolescents. The null hypothesis was rejected, and the alternative hypothesis was accepted. Texas adolescents who have tried e-cigarettes were less likely to rate perception of harm as less dangerous.

RQ2: How does exposure to state antitobacco programs influence the perception of harm of e-cigarette use in Texas adolescents?

$H_0$2: Exposure to state antitobacco programs does not influence the perception of harm of e-cigarette use in Texas adolescents.

H_a2: Exposure to state antitobacco programs does influence the perception of harm of e-cigarette use in Texas adolescents.

Research Question 2 was intended to determine the relationship between exposure to state antitobacco programs and perception of harm among demographic characteristics. The results of the OLR did conclude that exposure to school-based antitobacco programs does influence the perception of harm of e-cigarette use in Texas adolescents. The null hypothesis was rejected, and the alternative hypothesis was accepted. Texas adolescents who participated in a state antitobacco program were more likely to rate perception of harm as more dangerous.

RQ3: How does exposure to school-based antitobacco activities influence the perception of harm of e-cigarettes in Texas adolescents?

$H_0$3: Exposure to school-based antitobacco programs does not influence the perception of harm of e-cigarette use in Texas adolescents.

H_a3: Exposure to school-based antitobacco programs does influence the perception of harm of e-cigarette use in Texas adolescents.

Research Question 3 was intended to determine the relationship exposure to school-based antitobacco activities and perception of harm among demographic characteristics. The results of the OLR did conclude that exposure to school-based antitobacco programs does influence the perception of harm of e-cigarette use in Texas adolescents. The null hypothesis was rejected, and the alternative hypothesis was accepted. Texas adolescents who participated in a school-based antitobacco program were more likely to rate perception of harm as more dangerous.

RQ4: How does the relationship between e-cigarette use and perception of harm differ based on area of residence (state vs. coalition resident) in Texas adolescents?

$H_0$4: There is no relationship between e-cigarette use and perception of harm based on area of residence (state vs. coalition resident) in Texas adolescents.

H_a4: There is a relationship between e-cigarette use and perception of harm based on area of residence (state vs. coalition resident) in Texas adolescents.

Research Question 4 was intended to determine how the relationship between e-cigarette use and perception of harm differs based on residential area. The results of the OLR did yield a relationship between e-cigarette use and perception of harm based on area of residence. The null hypothesis was rejected, and the alternative hypothesis was accepted. Students who have tried e-cigarettes were less likely to rate perception of harmless dangerous if they lived in a state resident area compared to a coalition area

RQ5: How does the relationship between e-cigarette use and perception of harm differ based on socioeconomic status in Texas adolescents?

$H_0$5: There is no relationship between e-cigarette use and perception of harm based on socioeconomic status in Texas adolescents.

H_a5: There is a relationship between e-cigarette use and perception of harm based on socioeconomic status in Texas adolescents.

Research Question 5 was intended to determine how the relationship between e-cigarette use and perception of harm differs based on SES. The results of the OLR did yield a relationship between students who have tried e-cigarettes and perception of harm based on SES. The null hypothesis was rejected, and the alternative hypothesis was

accepted. Students who have never tried e-cigarettes were less likely to rate perception of harm less dangerous if they had a higher SES.

Limitations of the Study

This study had several limitations. First, the sample was limited to middle and high school students who were enrolled in a Texas public school. It did not consider students from charter or private schools, therefore making the findings less generalized to all middle and high school students. Second, the findings were based on cross-section data which did not establish the causality of association between variables. Due to the quantitative nature of the study, participants were not allowed to provide a detailed response to the questions. Data collected for this study was self-reported, which could lead to under or over-reporting of use among adolescents. Recall bias may have been a limitation for the questions regarding state and school antitobacco campaigns.

Recommendations

The focus of my study was to determine the perception of harm related to e-cigarette use among Texas youth. Though there are various school and state-funded antitobacco campaigns, they are not properly influencing the youth to decline or discontinue use of tobacco products including e-cigarettes. Additional studies are needed to determine the patterns and behaviors of Texas adolescents who use e-cigarettes in Texas. It is recommended that public health resources focus on developing tailored programs that aim to reduce the prevalence of e-cigarette use and stop the initiation of smoking in adolescents across Texas. This may include creating tailored campaigns for younger adolescents based on individual grade levels. For instance, although the study specific aim was to determine the perception of harm related to e-cigarette use among

Texas youth, study findings also showed there is a statistically significant inverse gradient in the perception of harm of sixth through eighth graders (middle school) but no significant difference across ninth to 12th graders (high school). Furthermore, it is also recommended to discontinue programs that are not beneficial in reducing e-cigarette use. This will allow tobacco funding to be redistributed to more effective antitobacco campaigns.

With the information gained from this study, Texas antitobacco campaigns should be designed in a more efficient way to encourage tobacco cessation. Public health officials should implement evidence-based interventions across the state to discourage use. Officials may also find it necessary to use various platforms such as social media outlets, to disseminate intervention methods. The results from the study may influence campaign organizers to focus on efforts to better encourage teens to not initiate tobacco use including e-cigarettes. Additional research should also focus on determining which antitobacco campaigns are more effective in discouraging use of e-cigarettes in adolescents. Additionally, future studies are also needed to examine whether household cigarette use influences the use or perception associated with e-cigarettes in adolescents.

Implications for Social Change

The findings of the study may provide potential impact for positive social change for adolescents and tobacco cessation. The study is important because it was able to identify the gap in knowledge regarding the perception of harm associated with e-cigarette use. For the adolescent population, though it is imperative that tobacco use be discontinued, the focus should be on abstaining from use. Disseminating this study into peer-reviewed journals may possibly increase the need to address the additional gaps in

research. This study may lead to an increased understanding of what factors are associated with an increased or decreased perception of harm. The findings of this study may encourage public health professionals to create and disseminate educational information including school and state activities and resources.

Conclusions

The results found in this cross-sectional, secondary data analysis study concluded that adolescents who have used e-cigarettes are less likely to perceive them as dangerous regardless of socioeconomic status or area of residence. The results of this study also indicated that Texas adolescent's exposed to state or school antitobacco programs are more likely to perceive e-cigarettes as harmful. Furthermore, this study adds value to existing research pertaining to the perception of harm in relation to electronic cigarette use and determining if current public health antitobacco campaigns are beneficial. Future health campaigns should focus on providing resources that discourage use and increases the negative perception of e-cigarette use when targeting adolescents. Future studies are necessary to explore what additional factors are influencing perception of harm and what programs are successful among the adolescent population. Overall implications from this research study may help provide the necessary evidence needed to encourage adolescents to not initiate or continue the use of tobacco products.

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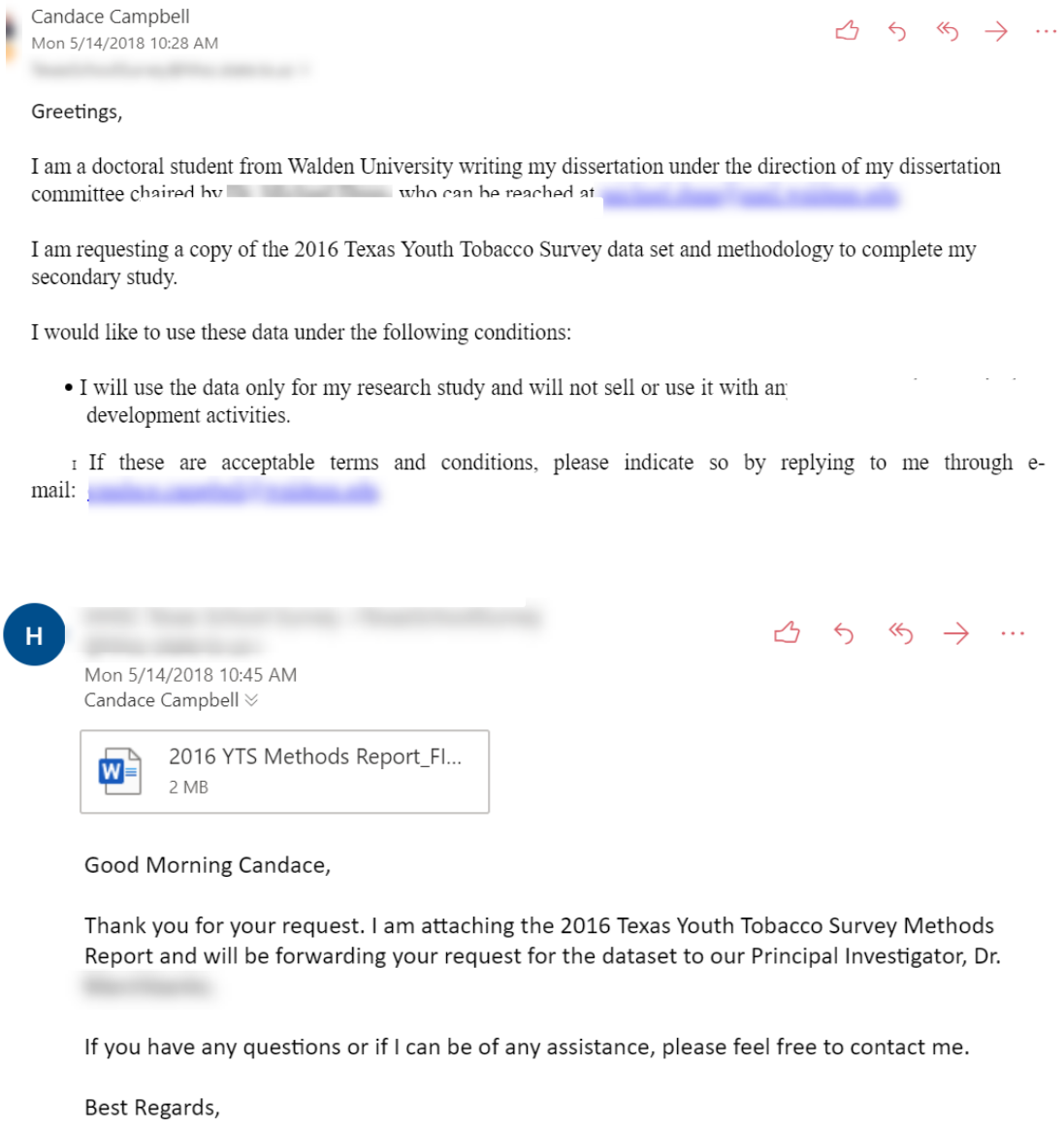
Appendix A: Email Request for Data Use



Candace Campbell
Mon 5/14/2018 10:28 AM

Greetings,

I am a doctoral student from Walden University writing my dissertation under the direction of my dissertation committee chaired by [redacted] who can be reached at [redacted]

I am requesting a copy of the 2016 Texas Youth Tobacco Survey data set and methodology to complete my secondary study.

I would like to use these data under the following conditions:

- I will use the data only for my research study and will not sell or use it with an[redacted] development activities.

If these are acceptable terms and conditions, please indicate so by replying to me through e-mail: [redacted]

H

Mon 5/14/2018 10:45 AM
Candace Campbell

2016 YTS Methods Report_FI...
2 MB

Good Morning Candace,

Thank you for your request. I am attaching the 2016 Texas Youth Tobacco Survey Methods Report and will be forwarding your request for the dataset to our Principal Investigator, Dr. [redacted]

If you have any questions or if I can be of any assistance, please feel free to contact me.

Best Regards,

Candace Campbell
Mon 5/14/2018 2:35 PM

Ms [redacted],

Is the survey and other material items such as the consent forms available to be published to the public? I want to make sure I can include an actual copy of the survey in my paper, or if its not allowed to be included.

Thanks!

Regards,

Candace Campbell

H

Candace Campbell

C_Information Sheet 2016.pdf
1 MB

2016 Proof.pdf
2 MB

2 attachments (3 MB) Download all Save all to OneDrive - Laureate Education - ACAD

Yes, I am attaching the 2016 survey instrument and the parental information document as requested.

Please feel free to contact me with any additional questions or if I can be of any further assistance.

Thank you,

H

Tue 5/15/2018 8:38 AM
Candace Campbell

YTS 2016 State Report.pdf
229 KB

Hi Candace,

I am attaching the requested 2016 Texas Youth Tobacco Survey Data. I will send the file via filex and will send you a separate email with an encryption code to access the data. Please note that filex will not store the files for more than a couple of days, so you will need to download the files to your computer.

The data is presented in both Stata and SAS formats. The data are weighted survey data, so please specify the "sweight2" variable as the weight and the "PSU" variable as the primary sampling unit when specifying your survey design (as you are probably aware not utilizing the survey weights would result in highly biased estimates). The variables of the form "Qsubstance_ever", "Qsubstance_month", along with "grade", and "race", are all recoded variables used in reports, while Q# variables reflect the original responses to questions.

I am also attaching a copy of the 2016 YTS state report for you as well.

If you have any questions or if I can be of any assistance, please feel free to contact me.

Candace Campbell
Fri 3/1/2019 9:12 AM

Good morning,

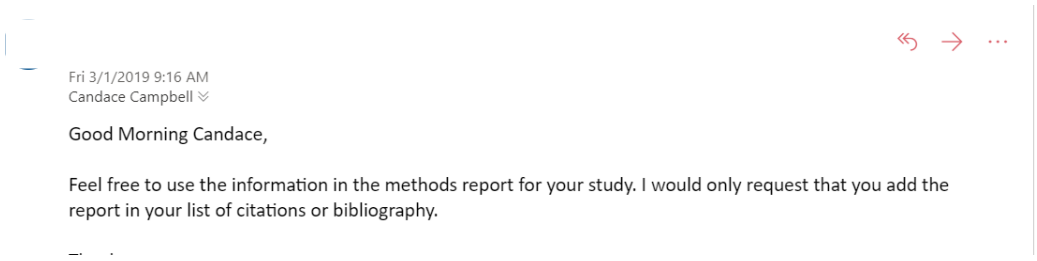
I have a few questions regarding the 2016 YTS Methodology Report. Does this document contain a copyright? I know the data is available to use but I am unsure if it is ok to reprint materials from the methodology report, such as the table below for age-based grade assignments, recruitment materials, classroom selection, or the actual survey instrument. If the information does contain a copyright, is it ok to reproduce this information and include a copy into my study? Thank you for your help.

Unreported Grade Levels

When students failed to report their grade level, unequivocally determining with which grade level the students' data should be analyzed was impossible. When a grade level was missing, an estimate of the grade was made based on the students' age, and the data were retained. Table 1 identifies the range of students' ages and the corresponding grade levels that were assigned.

TABLE 1. Age-Based Grade Assignments

Age	Grade Level		Age	Grade Level
11	6th Grade		15	10th Grade
12	7th Grade		16	11th Grade
13	8th Grade		17 or older	12th Grade
14	9th Grade			



Fri 3/1/2019 9:16 AM
Candace Campbell

Good Morning Candace,

Feel free to use the information in the methods report for your study. I would only request that you add the report in your list of citations or bibliography.